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FINAL REPORT

ECONOMIC ANALYSIS
OF THE VALUES OF SURFACE USES
OF STATE LANDS

Task 3
FAIR MARKET VALUE FOR GRAZING LEASES

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FINAL REPORT

ECONOMIC ANALYSIS OF THE VALUES OF SURFACE USES OF STATE LANDS

Task 3

FAIR MARKET VALUE FOR GRAZING LEASES

John Duffield
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ACKNOWLEDGEMENTS

We are indebted to a number of individuals who contributed time and thought to this study. We appreciated the patient, professional and courteous help of the Montana Agricultural Statistics Service staff. We are especially indebted to Jim Sands, Curt Lund, and Steve Susemihl for overseeing the grazing survey effort and for responding to numerous data requests. Steve Susemihl programmed the grazing survey instrument. Dan Ledbury provided us with historical data for private grazing leases in Montana. We thank Jon Souder for help with our literature review and for sharing his insights into policies in other states. We appreciated the assistance provided by Jeff Hagener and Gregory Hallsten in making data available from Department of State Lands files and for helping coordinate the survey effort. We also appreciated the cooperation of the commissioners and staff of the other western state land commissioner offices who participated in our survey and responded to data requests. Keith Kuhlman of Oklahoma and Linda Kehling, Cort Dewing, and John Wurdeman of Nebraska were particularly helpful. We appreciated the cooperation of Anita Bauer and Bill Nathwig in providing information on Bureau of Indian Affairs leases in Montana. We would like to acknowledge our appreciation for the hard work put in by our approximately 40 telephone survey operators. These surveys were generally implemented in the evening or on weekends. While too numerous to list, our enumerators' professional and timely implementation of the grazing survey was central to fulfilling our study objectives. We are likewise grateful to the over 1600 Montana ranchers who were kind enough to participate in the sometimes lengthy phone interviews. Finally, we appreciated the careful and timely review of our draft that was provided by Jim Almond, Dr. Brian Sindelar, John Hansen, Dr. Thomas Power and Dr. David Patterson. The authors are solely responsible for the interpretations made here or for any remaining errors.

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REFERENCES

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APPENDIX B. Pilot Grazing Phone Survey Instrument, Rangehands, Inc. (June 1992)

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EXECUTIVE SUMMARY

This report examines the fair market value for grazing leases on state school trust lands in Montana.

The State of Montana leased 4,296,385 acres for grazing use in 1992 (about 80% of all 5.2 million acres of state school trust lands). This land supports 1,023,200 contract AUMs and returned $4,341,521 in revenues in fiscal year 1992. This implies an average AUM rate of $4.24 and an average rental value per acre of $1.01. The AUM rate is very close to the minimum lease rate of $4.17 reflecting the fact that there is very little competitive bidding for state grazing leases.

The minimum lease rate is based on a formula of "six" times the beef price in the previous year. The value of "six" is based on an expectation of 50 pounds of weight gain per AUM, a "fair" landlords share of the land's share of production of 30% and an estimate of 40% of production being due to the land resource (30% times 40% times 50 equals six pounds). This formula has been revised upwards several times in the last twenty years. In 1962 the formula was only "one" (pound of beef) times the beef price. Due to changes in the AUM price formula, the state grazing lease rate has increased from about 15% of the average private market grazing lease rate in 1962-1963 to about 35% at present.

The central question examined in this report is whether the current lease rate returns a "full market value" to the school trust as required by the Montana Enabling Act of 1889 and by the Montana Constitution of 1972.

The analysis is based on a survey of 2,465 Montana ranchers administered by the Montana Agricultural Statistics Service (and in cooperation with the Wyoming Agricultural Statistics Service) in September-November 1992. The survey was conducted by phone following a mailing of a cover letter and key survey questions. The completion rate was 69%. The survey instrument was designed to collect information on private and public grazing lease rates and the important characteristics of each lease including services provided and other terms.

A total of 692 private leases and 315 state leases were identified in the survey. About 40% of private leases were on a dollar per AUM basis. The average private market lease rate was found to be $11.41 per AUM with a range of $1 to $20. Respondents were also asked the "average charge" for privately owned non-irrigated land in "your area". The reported average was $12.00, which is in close correspondence with the results of the annual July Cattle Survey administered throughout the western states by the Agricultural Statistics Service.

Six specific approaches were used to estimate a fair market value for state grazing leases. Each of these is summarized in Table S-1 and is briefly discussed in turn.

Our first approach is based on a statistical model (a so-called "hedonic model") that relates lease characteristics and terms to price for private market grazing leases. Lease

characteristics that could influence price include the term (number of years) of the lease, whether the lease is a newly held lease, provision of fencing maintenance and other services by the landlord, whether the lease is irrigated or dryland and region the lease is located in (e.g. central versus northeast Montana). The latter factor is included to account for differing market conditions across the state.

This model was estimated based on our sample of dollar/AUM private market leases. The model has a number of statistically significant parameters with the theoretically expected signs. For example, other things equal, if the landlord provides fence maintenance services, the tenant pays an AUM price that is about $1.50 higher on average. Similarly, leases with a term of greater than five years are worth about $2.00 less on average. Lease rates were significantly higher (almost $2.00) in central Montana counties such as Cascade; by contrast lease rates were about a dollar lower in the north central and northeast. This model was used to predict the market value of leases with characteristics similar to the typical state lease (no landlord provided fencing or water development services, terms greater than five years, not newly held, and dryland). For the "typical" state lease the specific estimate of fair market value is $7.69. Based on the estimated confidence interval for this predicted value, one can be 95 percent sure that the true mean is between $6.23 and $9.14. This range reflects the uncertainty in the parameters of the model and how close the values of the explanatory variables used in the prediction are to the means of these variables in the sample of private leases.

We also provide in this report region specific prices based on our finding of significantly higher prices in central Montana and significantly lower prices in northeast Montana. For region specific prices the hedonic model predicts a central Montana price of $9.56, a northeast Montana price of $7.13 and a "rest of the state" price of $8.16.

These prices based on the hedonic model are somewhat lower than the average market price because state leases are less likely to be on irrigated land and generally offer much lower levels of landlord services with regard to fencing and water. Additionally, state leases are much more likely to have been held for more than one year and are for a longer term.

Another way to estimate fair market prices (Table S-1) is to look at the average price of the private leases that are most like the state leases. The subsample of private AUM leases with term greater than 5 years, no fence maintenance services, and dryland only is $7.90. This is based on a small sample of six leases with the specific values of $3.91, $7.50, $8.00, $8.00, $8.00 and $12.00.

A third way to estimate a market value of state leases is to look at the average competitive bid for the 8% of all state school land grazing leases which are competitive bid. As discussed in this report, leases which are competitively bid are not significantly different from other state leases regarding services and land type. The average competitive bid for state leases is $8.34, based on a sample of all 613 competitively bid state leases.

A fourth approach is to look at what ranchers report is a fair price for state leases. A total of 601 respondents gave us an AUM-based average price for private leases in their area and the

percent of that average private lease rate that they thought represented a fair price for state leases. The percent-weighted average is $9.01. The subsample of respondents to this question who hold state leases have an average percent-weighted fair price of $7.62.

A fifth approach is to examine what other public land management agencies charge for private grazing leases. BLM and Forest Service lease rates are set by formula (at $1.92 for our study year) and do not provide useful information on the forage lease market. However, Bureau of Indian Afffairs (BIA) leases do appear to represent market leasing rates. According to BIA personnel, BIA leases are determined by competitive bid and negotiation. In our sample of 32 BIA leases the average lease was at $8.37 and the range was from $5.85 to $14.00. These leases are similar to state leases in that they typically have few landlord services. In May 1992, the BIA issued an appraisal for leases on the Fort Peck Reservation. The appraiser, Anita Bauer, reported that through a phone survey she identified 17 useable private leases both on and off the Fort Peck Reservation. The average market price where landlord provided all the livestock care was $11.00/AUM and where the tenant provided all the care the average price was $8.35/AUM. This is consistent with the findings for northeastern Montana of our survey undertaken for state lands. Anita Bauer concluded that a rate of $8.00 was a fair market value for BIA range units in the Fort Peck area. BIA's policy is that tribal members have discounted minimum bid rates- in this case $7.00.

A final perspective on a fair market AUM-based price is provided by our literature review. Torell, Ghosh, and Fowler, 1988 did a study of the value of public grazing leases in New Mexico. The study found that about 30% of the private market lease rate was for services. Accordingly, They suggest that the value of forage on public leases (at least for New Mexico) is given by taking 70% of the private market lease rate for nonirrigated lands. Assuming that this ratio holds for Montana, and applying it to our dryland private reference price in Table S-1 (at $11.27/AUM) yields an estimate of the value of state grazing leases in Montana at $7.89.

All six of the methods tend to lead to a fair market value for state grazing leases that is around 70% of the private dryland lease rate (last column of Table S-1). The only approach that is much higher is the rancher "reported" fair price for the group of all ranchers at $9.01. All the other estimates are bracketed by the fairly narrow range of $7.62 to $8.37. This evidence suggest a fair market price of between $7.50 and $8.50, with a point estimate of $8.00.

Currently the state uses a minimum bid price of $4.17. This is really a default price in that there is very little competitive bidding for state grazing leases. Should the state choose to set a default price at something closer to fair market value, say $7.50 or $8.00, one way to do this would be to simply change the "pound factor" in the beef price formula from "six" to another base. For example, a price of $7.50 (when beef is $0.695 per pound) is given by using the factor 10.8.

It may be noted that this specific "pound factor" (of 10.8) has the interpretation of being 21% of the supposed 50 pound weight gain per AUM. (The current price of $4.17 is based on a percentage of 12%, as discussed earlier.) Interestingly, this is quite close to the factor

used by South Dakota in its beef price formula. South Dakota uses 20% and has a current AUM price of $7.08. Oklahoma also used to employ a beef price formula. For example, the AUM price in Oklahoma in 1980 was $7.41/AUM based on a 25% share to the state land office, the weight of an average yearling calf (425 pounds in a year or 35.4 pounds in a month) and the price of calves ($0.837/lb in 1980).

A related question is whether the beef price is a good way to keep the AUM price up to date. Our analysis shows that over the long term it is; our model relating AUM price to beef price for western states showed a very high correlation (adjusted R-square of .85). However, this result may be dominated by the long term effect of overall price inflation in the economy (making both beef prices and forage rental rates move together over time). The relationship of beef price and the AUM market rate in the shorter term (the last ten years) shows a much weaker relationship. These somewhat mixed results suggest that if Montana is only going to study its grazing fees at lengthy intervals, the beef price index approach is reasonable in the long term. However, greater realism would result from a formula that ties the state lease rate to actual market lease rates for forage, rather than the beef price. These lease rates are already available on an annual basis from the July cattle survey. As discussed above, this survey of "reported average in your area" seems to provide a good approximation to actual market leases. We would strongly recommend tying the state grazing lease rate to the private market lease rate. One approach would be to just make the state lease rate equal to 70% of the most recent reported private market grazing lease rate. The state could adopt a policy of adjusting lease rates annually as soon as the new July cattle survey results are available. There is usually a very quick turnaround in the availability of these results from the Agricultural Statistics Service. The state could also cooperate with Montana Agricultural Statistics to have private market grazing lease rates reported on a district level (e.g. northeast Montana, central Montana, etc.). This may be justified given our findings of significant differences in private lease rates in different areas of the state.

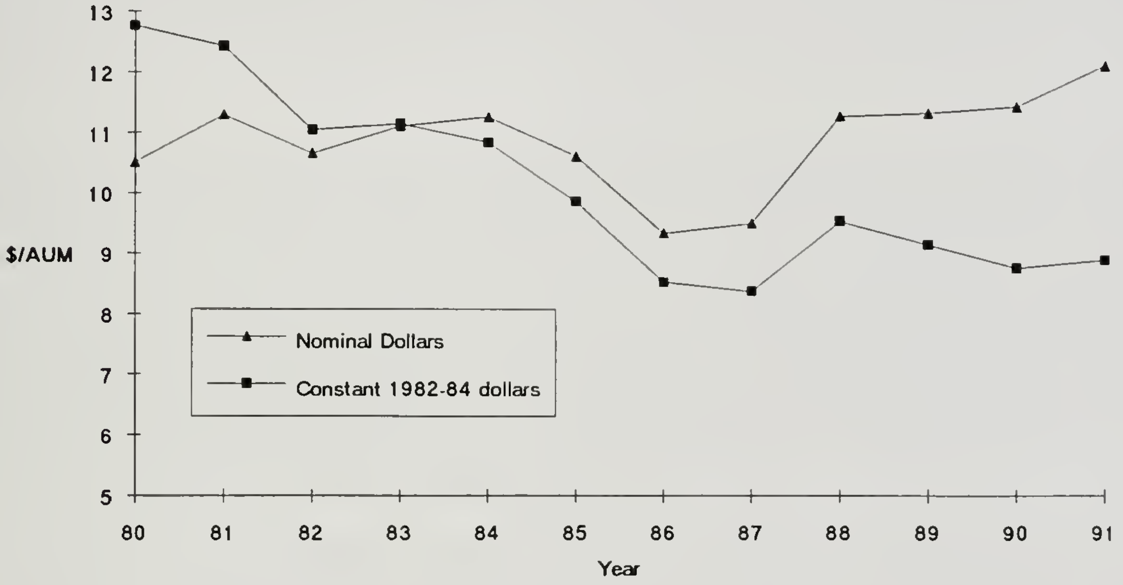
Note that in Table S-1 the estimated fair market prices for state grazing leases are compared to our survey-based estimate of private dryland grazing leases in Montana of $11.27 for 1992. Typically the ratio of out various estimates to the $11.27 value are around 70%. However, if state lease rates are to be tied to the "reported" typical prices based on the July cattle survey, the latter (at around $12.00/AUM) appear to be somewhat higher than the estimate based on an actual sample of contract leases. If a point estimate for the fair market value on state leases is about $8.00 and the July cattle survey estimates are around $12.00, this suggests setting state leases not at 70% of the July Agricultural Statistics Service estimate, but rather at two thirds (66.7%).

We note that several of our reviewers expressed concern that private market lease rates in 1992 may have been high compared to the historical average due to drought conditions. This could be a legitimate concern if we were suggesting that our estimate of fair market price for forage for 1992 be used for a number of years. This is not our recommendation. State lease rates should be tied to market rates and adjusted annually. By tying state lease rates to actual private grazing lease rates on an annual basis, one automatically corrects for all market effects. For example, if drought has increased the market price for 1992 and there is no drought in 1993, then (other things equal) market prices for forage will go down in 1993 and

this change would be reflected in state lease rates that are tied to the market price.

It is interesting to note that there has been considerable movement in private market grazing lease rate over time (Figure S-1). In recent years prices did increase substantially from 1987 to 1988 (both in nominal and constant dollar terms). This may in part be due to drought conditions in 1988. Between 1988 and 1991 private market grazing lease rates declined to 1990 and then increased just slightly in 1991.

Table S-1. Private Montana AUM lease rates from 1980-1981.



An alternative basis for charging on state grazing leases is to use a dollar per acre rather than a dollar per AUM approach. In fact the way Montana state leases are administered is in some ways more akin to a dollar per acre or lump sum lease basis. State lands have no provision for "non-use" such as the Forest Service or BLM grazing leases and permits. This means that the tenant must pay for a state lease regardless of whether or not there is forage for his or her livestock. The state establishes carrying capacity for a given lease that is estimated at ten year intervals. Contract rent is based on the AUM capacity times the dollar/AUM formula value. Since stocking rates are not monitored by the state, in practice the state's dollar/AUM contracts are more like a fixed sum or dollar per acre contract. In the private market, AUM based contract total payments are usually adjusted to reflect the actual AUM's used. In this way, there is some risk sharing if forage is limited due to drought or other factors.

Several of our reviewers commented on the fact that state leases have no "non-use" provisions such as for Forest Service or BLM leases, and suggested that this might reduce the value of the lease. The other side of this coin is that the state also does not have any "over-use" provisions. Unlike the Forest Service, the state does not count stock off the lease to verify that the contract stocking rate is not exceeded. We would recommend that actual

stocking rates on state leases be given further study.

Given the way state leases are actually administered is more like a cash rent basis, it is of interest to examine the private market for dollar/acre leases. The private market dollar/acre leases that are most like state leases (term greater than 5 years, dryland and no fence maintenance services) average $1.77 per acre (sample of only eight leases. Based on our comparison of productivity and forage quality, state leases are similar to this subsample of private leases. Similarly leases on a dollar/ranch basis average $2.26 per acre for the subsample of private market leases most like state leases (sample of eight leases). By comparison to the current average value the state receives per acre ($1.01), these findings suggest that fair market state lease rates on a per acre basis could be around $2.00 or double the current level. These findings are similar to the AUM-based discussion summarized in Table S-1.

Another concern of our reviewers was that state leases are more likely to be inholdings than private leases. Our hedonic model showed that several factors (both whether the lease was an inholding totally surrounded by private ground and also whether noxious weeds were a problem on the lease) had a small negative effect on private lease market rates- on the order of $0.40/AUM. However, these estimated marginal prices were not statistically different from zero. A larger sample might show these factors to be statistically significant. Even if these effects on price due to inholdings and noxious weeds were valid, they would apply to only a fraction of state lands that are inholdings (36 percent) and have noxious weed problems (22 percent). This would indicate a price adjustment for these leases of around 15 cents for inholdings and 10 cents for noxious weeds.

The inholding issue is troublesome because these units are typically unfenced. This means that the only logical user of these units is the rancher who owns the surrouding land. This means there is unlikely to be competition for the lease, but it also means the rancher has little choice but to use the unit and pay the state-determined rate. As long as the state rates are fairly determined, this shouldn't pose a problem. Recall that the usual definition of a fair market price is the price that a willing buyer and a willing seller will agree to. In the long run, it would be better if the state could sell or exchange inholdings and block up more economic range units. This could be accomplished through a "land bank" policy such as is used in other states and discussed in our Task 2 report. This would lead to more competition for state leases and higher returns to the trust.

Another perspective on fair market lease rates for Montana is provided by the example of other western states. Montana is toward the lower end of the scale in terms of the ratio of state grazing lease rates as a percentage of market value. Montana's state school lease rates are currently about 35% of private grazing lease rates.

Nebraska and Oklahoma stand out as the two states that have most successfully used competitive bidding and the elimination of preference rights to increase returns on state grazing leases. Both of these states experienced lawsuits in which claimants charged that fair market value was not being realized on state grazing leases. The suit in Oklahoma, in the early 1980's, resulted in a doubling of lease rates and a change to oral auctions on all leases.

Minimum lease rates in Oklahoma are set for each lease by appraisal at market value. The range of these lease rates is currently from 75% to 135% of the average private market lease rate. Procedures are similar in Nebraska, with lease rates ranging from 60% to 100% of the average private market lease rate. Despite near-market lease rates, these states have only a very few leases that are vacant.

As a result of an intensive (and extensive) survey of Montana ranchers concerning grazing lease rates and four additional methods of analysis, we conclude that current state lease rates are much lower than current fair market value. Lease rates on Montana DSL grazing leases currently average $4.24 per AUM. The preceding analysis suggests that fair market value for these leases is on the order $7.50 to $8.50 per AUM.

Table S-1. Summary of alternative estimates of fair market value for Montana state lands grazing leases (1992 dollar/AUM basis).

Estimate	Mean $/AUM	95% Confid. Interval	Standard Error	Sample Size	Percent of private dryland
A. Private market reference prices.					
All private leases	11.41	11.06 - 11.76	0.180	243	101
Dryland private	11.27	10.89 - 11.65	0.196	207	100
B. Estimates of fair market value for Montana state grazing leases.					
1. Hedonic model "typical state lease" (no services, term > 5 years)	7.69	6.23 - 9.14	0.740	139	67
2. Subsample of private leases: >5 year, no fence maintenance services, dryland.	7.90	5.85 - 9.95	1.045	6	69
3. Competitive bids for state grazing leases.	8.34			613	73
4. Rancher "reported" fair price for state lease					
- all ranchers	9.01	8.68 - 9.34	0.170	601	79
- state lease holders	7.62	6.93 - 8.31	0.350	137	67
5. BIA Montana Leases	8.37	7.63 - 9.11	0.380	32	74
6. Literature review: (Torell, Ghosh, and Fowler, 1988) ratio of public lease forage value to private					
- New Mexico estimate					70
- Applied to Montana	7.89	7.62 - 8.16	0.137	207	70

Note: Standard error for estimate 5. assumes the ratio .70 is a known constant.

1.0 INTRODUCTION

1.1 Introduction

This is a report for the Montana Department of State Lands on the subject of fair market values for grazing leases. Grazing leases are Task 3 in a larger project, "Economic Analysis of the Values of Surface Uses of State Lands", which is being conducted by Bioeconomics, Inc. of Missoula, Montana. This study began on May 18, 1992 and is to be largely completed by late December 1992.

The basic approach to this problem is to collect information on current actual leases for all types of grazing in the State of Montana. The primary information needed is the market prices and terms for private market leases. The variation of market prices with lease terms and services is analyzed. Lease terms and services on state grazing leases are also be examined. A fair market price for state grazing leases is determined based on market prices for leases with comparable terms and services.

This analysis of grazing leases was conducted in two phases. The first phase included a pilot survey to identify the key determinants of grazing fees. This information was used to develop a survey instrument to be implemented on a sample of 2500 Montana cattle and sheep ranchers by the Montana Agricultural Statistics Service. This phase began on May 18 and was completed on September 27.

The second phase of the study was the implementation of the survey, analysis, and report writing. This phase began on September 28 (the first night of phone interviewing) and was completed in December 1992 with this final report. The following sections of this report describe in turn the study methods, data collection, results, and implications for policy toward grazing leases.

1.2 Background and Literature Review

Establishing grazing fees on public lands is a long-standing and emotional issue. Most of the literature in this area has focused on setting fees on federal lands (Brokken and McCarl 1985; Torell and Doll 1991; Workman 1988; Borman and Johnson 1990). Work specific to grazing fees on state lands include a study of rangeland conditions in Colorado (Roath 1991) and policy studies emphasizing differences in grazing land management and fee strategies across states (Bartlett, McKean and Winger 1983; Souder 1990; Souder and Fairfax 1990; Souder and Fairfax 1991).

The simple facts of the situation are that private grazing leases are at much higher rates on average than fees on public ground. This has led to the general perception that public leases are underpriced. Private grazing leases in the Western U.S. averaged $9.66 per AUM in

1991. In Montana they averaged $10.58 for that year. The lease rates on federal lands are much lower than private fees - $1.92 per AUM. Lease rates on state lands vary by state (Table 1-1) and in 1991 were $4.24 in Montana and ranged from $1.48 in Arizona to $18.00 on some leases in Nebraska (Table 1-2 and Figure 1-1). The minimum lease rate in Montana in 1992 is $4.17 per AUM. Montana is toward the low end of the scale in terms of the ratio of the state grazing lease rate to the private market lease rate (Figure 1-2).

The basis for annual data on private market lease rates is the July Cattle Survey implemented by the Agricultural Statistics Service in each state (including Montana). A copy of the relevant portion of this survey is provided in Appendix F. The survey basically asks the respondent to "report" what the average private grazing lease rate is in their area. There are two limitations to this data as far as providing a basis for determining a fair market value on public lands. First, the question does not ask the person to identify actual transactions but "to recall or speculate on values" (USDA, 1992). Secondly, it is not obvious that the terms, conditions of the land, and services provided on the average private lease correspond to the average public lease. For example, if the average public lease does not include important services which affect the cost and productivity of holding the lease (such as who pays for fencing, water improvements, etc.), the fair market value for these leases may in fact be below the market average.

The only other major data base on this issue was collected in a mass appraisal effort undertaken in 16 western states in 1983 (Tittman and Brownell 1984). In this study field appraisers interviewed approximately 100,000 individuals and were able to identify 7,246 usable observations of different prices reflecting the results of open market negotiations between lessors and lessees for grazing use of lands. The finding of this study were that 1) appraised market values were similar to the results of the July cattle survey and 2) the only factors that significantly affected prices were "prepayment" and "conditions of use". The appraisers suggested that these findings be used to adjust the appraised market values downward by 10 percent and 5 percent respectively to determine an appropriate federal lease rate. This means that the private market lease rate that held in 1991 of $9.00 in "pricing area 3" (including Montana) should be adjusted to $7.74 for grazing on public rangelands. The results of this appraisal effort have been controversial (USDA 1992). Some critics believe that there was a failure to collect sufficient lease-specific information on services and maintenance and that the statistical analysis was flawed.

A comprehensive review of these issues is provided by a report of the Secretaries of Agriculture and Interior to the U.S. Congress in 1986, entitled "Grazing Fee Review and Evaluation". This study was updated in April, 1992. As discussed in this report, federal fees are based on the so-called PRIA formula. The PRIA formula is: Calculated Fee = $1.23 x (FVI + BCPI-PPI)/100 where $1.23 is the base price from a survey in 1966, FVI is a the Forage Value Index (based on the July Cattle Survey index of annually surveyed private grazing land lease rates with 1964-1968=100), BCPI is a beef cattle price index and PPI is an index of prices that livestock producer costs. This formula generates very low fees at present because it includes the factor to take account of producer costs, which have been

Table 1-1. Montana Private and State Range Lease Rate (Dollars/AUM).

Year	Montana Private Range Lease Rate[4]				State Base AUM Rate[3]	Ratio State Base/Combined
	Sources Combined	NASS AUM Published[1]	ERS/FS HM Records[2]	ERS Published[2]		
1960	2.59		2.59			
1961	2.71		2.71			
1962	2.82		2.82		0.48	0.17
1963	2.95		2.95		0.46	0.16
1964	3.03		3.03		0.76	0.25
1965	3.14			3.14	0.70	0.22
1966	3.31			3.31	0.68	0.21
1967	3.59			3.59	0.74	0.21
1968	3.66			3.66	0.76	0.21
1969	3.71			3.71	0.76	0.20
1970	3.87			3.87	0.80	0.21
1971	4.03			4.03	0.75	0.19
1972	4.32			4.32	0.87	0.21
1973	4.82			4.82	0.95	0.20
1974	6.60			6.60	1.69	0.26
1975	7.00			7.00	1.79	0.26
1976	7.40			7.40	1.30	0.18
1977	7.30			7.30	1.48	0.20
1978	7.40			7.40	1.45	0.20
1979	7.78	7.78		8.40	1.68	0.22
1980	9.07	9.07			3.64	0.40
1981	9.40	9.40			3.85	0.41
1982	8.90	8.90			3.47	0.39
1983	9.23	9.23			2.97	0.32
1984	9.48	9.48			3.00	0.32
1985	8.80	8.80			2.74	0.31
1986	8.30	8.30			2.81	0.34
1987	7.94	7.94			2.77	0.35
1988	9.79	9.79			3.27	0.33
1989	9.61	9.61			3.89	0.40
1990	9.61	9.61			3.92	0.41
1991	10.58	10.58			4.24	0.40
1992	11.86	11.86			4.17	0.35

1. National Agricultural Statistics Service Price Reports 1979-1982.

2. Unpublished NASS data provided to the Forest Service and Economic Research Service 1960-1978. Data from general farm questionnaire 1977 and earlier, JES/JAS since 1978.

3. Cow/Calf basis. 4. AUM basis.

Table 1-2. Montana state AUM lease rate and ratio of state to private lease rate.

State	State AUM Lease Rate ($/AUM)[1]	Ag Stat July Cattle 1992[2]	Ratio of State/Private[4]
AZ[3]	1.48	5.53	0.27
CA	1.92 to 4.00	13.29	0.14 to 0.30
CO	4.70	12.35	0.38
ID	4.99	10.85	0.46
MT	4.17	12.61	0.33
NE	11.00 to18.00	17.85	0.62 to 1.00
NM[3]	3.29	6.95	0.47
ND	7.50	10.78	0.70
OK	6.50 to 11.25	8.57	0.76 to 1.31
OR	2.50 to 3.50	9.14	0.27 to 0.38
SD	7.08	14.95	0.47
TX	4.17	10.64	0.39
UT	2.32	12.03	0.19
WA	4.95 to 6.20	13.01	0.38 to 0.48
WY	2.50	12.21	0.20

1. Survey by Jim Boyer, except Nebraska (from Linda Kehling), Oklahoma (Keith Kuhlman), California (Don Reese).

2. National Agricultural Statistics Survey, July Cattle Survey, units: $/AUM (cow/calf pair).

3. Values for Arizona, New Mexico are for an "Animal Unit" (83% of a Cow Calf pair). Other states are cow-calf pair definition.

4. Ratio of state to private lease rates is derived from the first two columns. When a mean or a single rate is available it is reported for a state. The state rate is reported as a range (not a mean or a median) for CA, NE, OK, OR, WA. Note NE, ND, OK, and SD do not have preference rights for lease renewal. For states where most original grant land has been sold (e.g. CA), state lease lands may be lower quality than average private leased lands.

Figure 1-1. State land lease rate and private grazing lease rate for 14 western states, 1992.

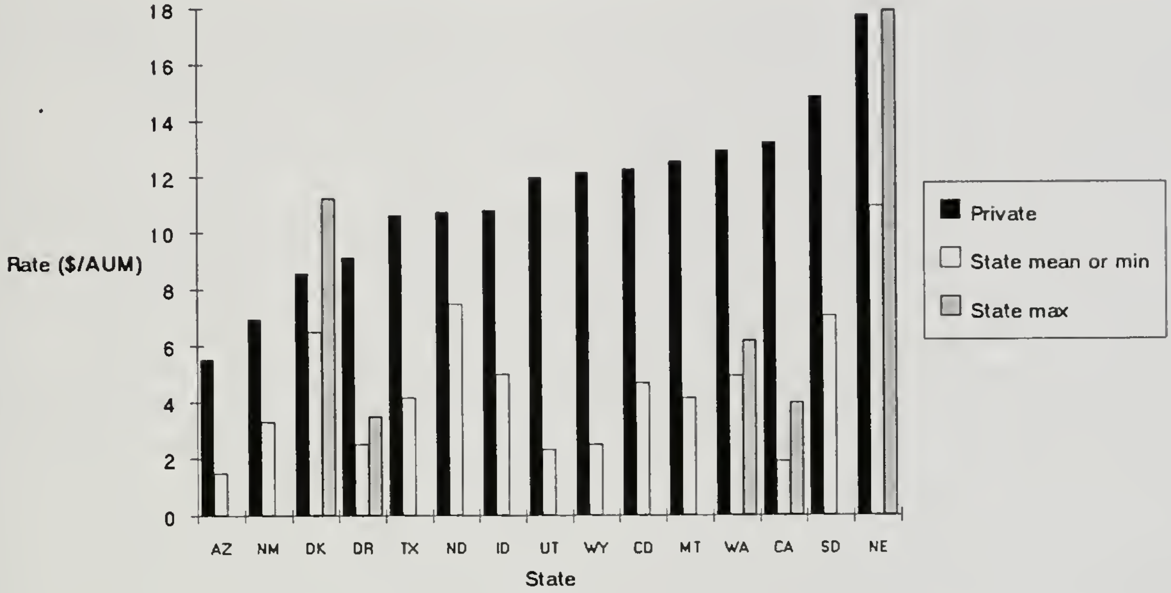
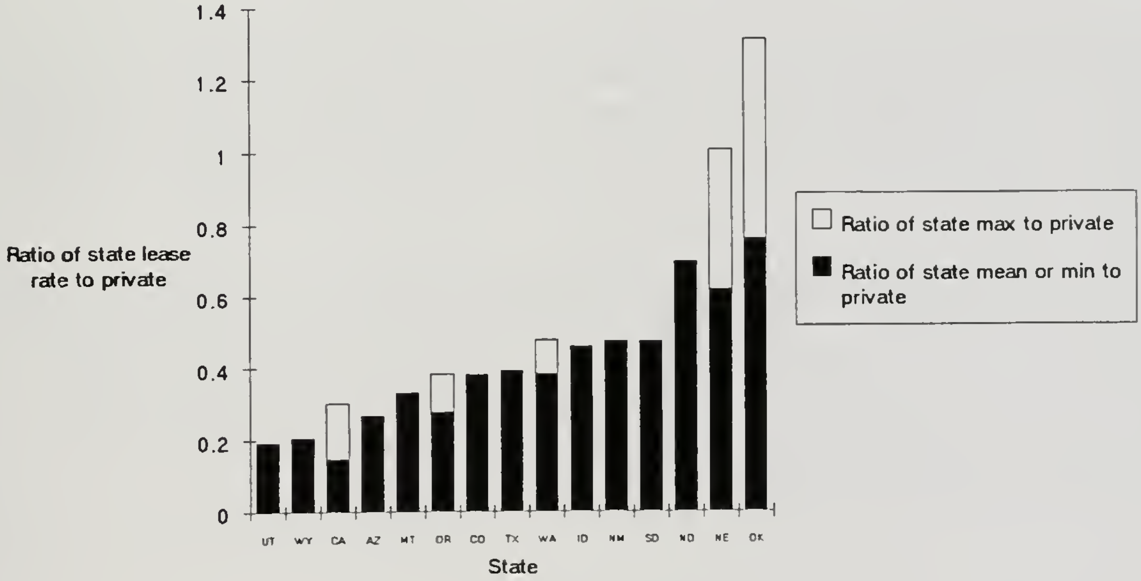


Figure 1-2. Ratio of state lease to private lease, ranked by rates.



rising faster than grazing lease rates in recent years (see the discussion in USDA 1992 beginning p. 17). This formula is designed to moderate what is paid on private leases with considerations of producer "ability to pay". In other words, the federal formula is not designed to accurately determine fair market value but is a compromise that takes into account fairness or distributive considerations of economic impact on ranchers.

The basis for setting grazing fees on state lands varies dramatically across states (Souder and Fairfax 1990). The formula is Montana is strictly a beef price system, with the grazing fee equal to six times the price per pound of beef. (Beef price is based on hundredweight prices for the previous year as computed by the Montana Agricultural Statistics Service.) The underlying basis for this approach (which is identical to the formula used in the state of Washington) is a share formula which assumes that the average gain in weight from an AUM of forage is 50 pounds, that the portion of the permittee's production investment assigned to the land is 40% (or 20 pounds), and that the landlord's fair share of income attributable to land is 30%. Thirty percent of this 20 pounds is 6 pounds. In other words, of 50 pound weight gain from an AUM of forage, the landlord's share for the land is 6 pounds. This simplifies to six times the price per pound of beef for an AUM fee (Souder and Fairfax 1990, p.43 and Bartlett, McKean and Winger 1983 p. 171). In this sense, the approach to setting grazing fees in Montana is conceptually similar to a cropshare approach with previous year's beef prices used to keep the production value (being shared) current from year to year.

The Montana formula obviously rests on assumptions about: 1) actual weight gain from an AUM, 2) share of production investment in land, and 3) a fair share to the landlord. It would be a coincidence if, in any given year, the value resulting from this precise formula happened to equal the actual average market price of an AUM in Montana. Nonetheless, it is possible that this formula may provide a reasonable approximation to a "fair market price" from year to year.

The historical state AUM lease rates and associated grazing revenues for Montana are shown in Table 1-3 for 1962-1992. As described in the footnotes to this table, Montana's formula has evolved from 1 pound multiplied by the price of beef (beginning 1953) to 6 pounds at present. This is also illustrated in Figure 1-3. The effect of these changes has been to the Department of State Lands AUM rate from about 15% of the average market lease rate in 1962-63 to around 35% at present (Figure 1-4).

Table 1-3. Montana AUM rates and total revenues derived from state grazing leases from 1962-1993.

FY	Base rate ($/AUM)	Total grazing revenues
62	0.48	693,854
63	0.46	705,885
64*	0.76	1,025,050
65	0.70	959,503
66	0.68	934,414
67	0.74	964,897
68	0.76	1,000,003
69	0.76	987,658
70	0.80	1,046,969
71	0.75	1,129,996
72	0.87	1,186,595
73	0.95	1,320,467
74*	1.69	2,163,807
75	1.79	2,287,854
76	1.30	1,754,287
77	1.48	1,955,647
78	1.45	1,923,235
79	1.68	2,203,847
80*	3.64	4,339,941
81	3.85	4,587,130
82	3.47	4,143,835
83	2.97	3,528,904
84	3.00	3,544,790
85	2.74	3,149,338
86	2.81	3,262,417
87	2.77	3,234,765
88	3.27	3,557,287
89	3.89	4,120,289
90	3.92	4,133,290
91	4.24	4,397,372
92*	4.17	4,341,521
93	4.03	not completed

* History of grazing rate calculations:

1953-63. Single rate based on the average price per pound of beef cattle sold the previous year (September 1 - August 31).

1964-73. Three rates based on the AU rating per section. The base rate calculated based on $0.32 + (2 x the average price per pound of beef sold the previous year). "A" rate (20 AU and above)= (base rate + $0.10). "C" rate (14 AU and below) = base rate - $0.10.

1974-79. Continued three rates with the base rate of $0.50 + (3 x the average price per pound of beef sold the previous year).

1980-91. Continued three rates with the base rate of 6 x the price per pound of beef sold the previous year.

1992-present. Single rate of 6 x the price of beef sold the previous year.

Additional notes. The number of AUMs varies from year to year. Therefore, part of the variance in the total revenues is related to different AUM totals per year.

Figure 1-3. Montana State Grazing Lease Base Rate from 1962-1993.

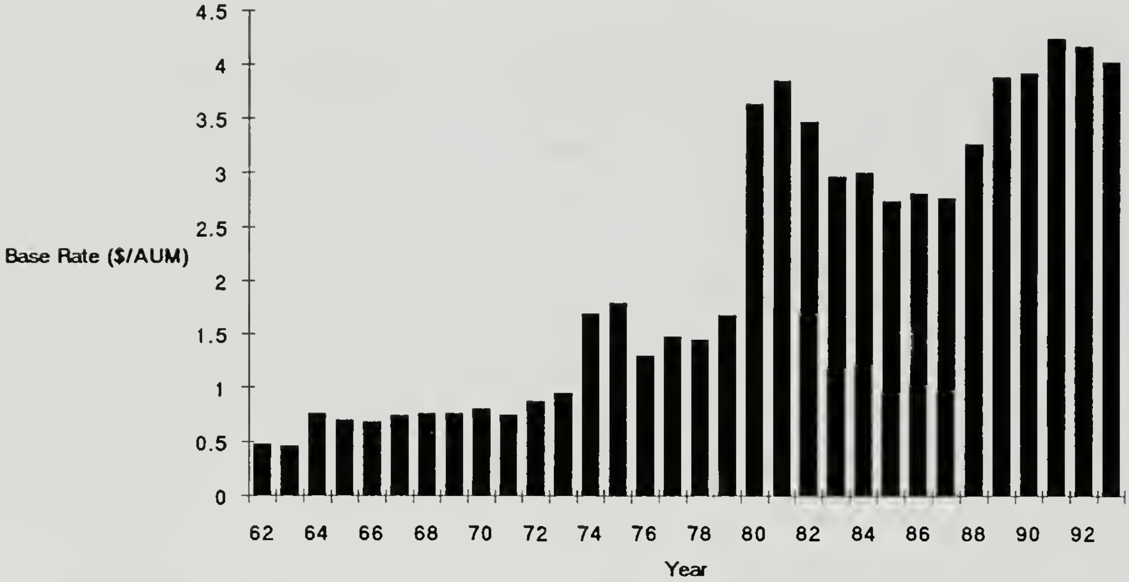
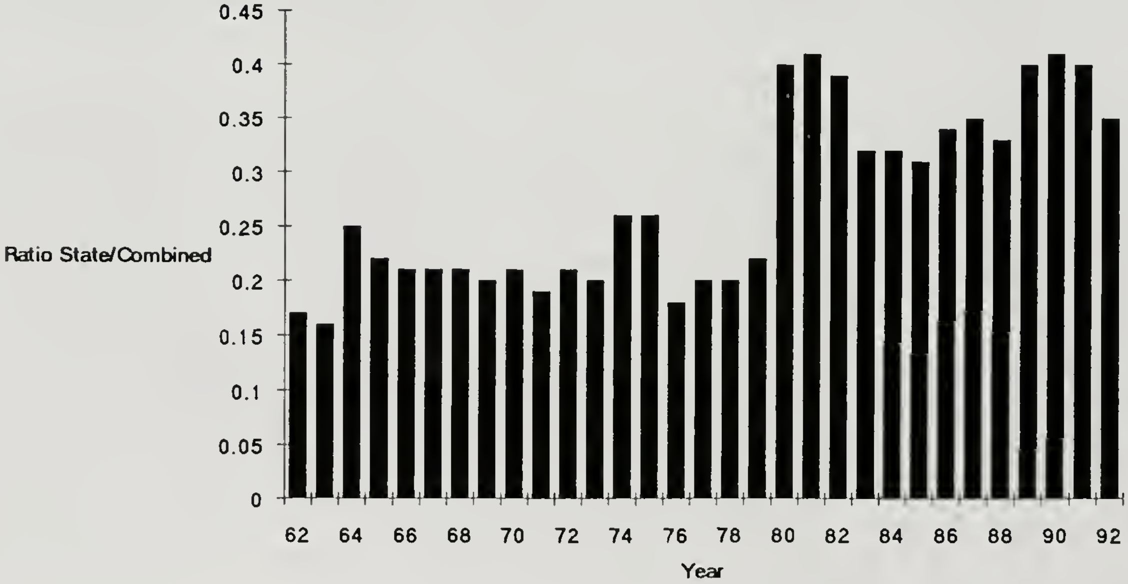


Figure 1-4. Ratio of state lease rate to private "combined sources" lease rate from 1962-1992.



2.0 METHODS

2.1 Theory and Methods

Based on our review of the literature, we concluded that the information necessary to determine fair market value of grazing leases on state lands in Montana was not currently available. Rather than "reported" values it is necessary to have data on actual lease contracts. Only by obtaining information on the lease terms (length of contract, services, cost sharing, productivity, etc.) can one determine a fair market value for comparable public ground. Our goal was to design a survey that identified the relevant prices and lease terms. An intermediate goal was to define the specific factors and terms that were most important in determining lease prices. We chose to accomplish this goal by conducting a pilot survey.

In the following sections we describe in greater detail the specific methods used, including the pilot survey.

2.2 Hedonic Price Model

A primary objective of this study was to develop a model of how private market lease rates for grazing vary with lease terms and services. Such a model can then be used to predict a "fair market value" for a group of leases with similar lease terms and characteristics, such as leases on Montana state school trust lands.

The theoretical model adopted for this study is what is called a "hedonic price model" (Rosen, 1974). The central idea is that houses or land or similar goods can be modeled as single commodities differentiated by the amounts of various characteristics they contain. This model rests on a theory of product differentiation in pure competition. For example, one of the earliest hedonic price studies, by Ridker and Henning (1967) was an analysis of the relationship of housing prices to air pollution levels in St. Louis. The authors used a cross-section of observations on 167 census tracts where single family housing dominated. The relationship between housing prices and various characteristics was examined. Explanatory variables included an air pollution index, medium number of rooms in the homes, houses per square mile (proxy for lot size), proximity to shopping and the central business district, school quality and crime rates. By controlling for the factors that affect price in a statistical model, one can identify the relationship of price and specific individual characteristics of interest, such as air pollution.

The hedonic price schedule reflects an equilibrium from the interaction of consumers, who benefit from the characteristics, and producers or sellers of the commodities, who incur costs. The costs are dependent on the variety and amount of characteristics provided in these differentiated products. In the Rosen (1974) model, the differentiated product is represented by a vector Z ($Z = z_1, z_2, \ldots, z_n$) where the product characteristics are z_i. The marginal price of a given characteristic is the partial derivative of the total price P with respect to that characteristic, or $\delta P/\delta z_i$. The model estimated is simply P as a function of Z; for example in a linear specification:

$$P=\alpha+\beta_1 z_1+...+\beta_n z_n \tag{1}$$

For the application at hand, we view grazing leases as contracts for a differentiated product. The product is grazing services which is primarily forage or grass but includes a number of other aspects as well. On an a priori basis, we would expect the key characteristics of the "grazing product" to include the type and extent of services included in the lease price (such as fence maintenance, water improvements, and herd management), the productivity of the lease (for example, measured by weight gain), livestock performance (such as the conception rates of cows pastured on the lease), security of the livestock, and the term of the lease (number of years the contract is for). In order to obtain some insight into the key characteristics, we conducted a pilot survey (as described in a following section). The pilot survey was undertaken to ensure that we designed a final survey instrument (Appendix F) that asked respondents about the primary characteristics of interest.

The only other formal economic model utilized in this study was a contingent valuation model. Contingent valuation is a survey approach in which respondents are asked their willingness to pay for a given service or commodity (Ward and Duffield 1992). A possibly important change in the characteristics of grazing leases on state lands is that as of March 1 of this year, holders of a State Lands recreational use permit can have access to these leases for fishing and hunting. We wanted to investigate how this change was valued from the standpoint of grazing leaseholders. One would expect that recreational access could impose costs on current leaseholders. One approach to valuing this change is to ask leaseholders their willingness to pay to control access rights. The specific contingent valuation method used was dichotomous choice. In this question format, respondents are faced with a fixed bid amount and reply "yes" or "no" as to whether they would be willing to pay that amount for the resource or right in question. (See Appendix F, question 25A in Section C for the wording of this question.)

We will briefly describe the theoretical motivation for dichotomous choice models. Hanneman (1984) provides both a utility difference approach and an alternative derivation based on the relationship of the individual's unobserved true valuation compared to the offered threshold sum (see also Cameron 1988). In the latter, it is assumed that if each individual has a true willingness-to-pay (WTP), then the individual will respond positively to a given bid only if his WTP is greater than the bid. For example, suppose that an individual is confronted with an offered price (t) for access to a given resource or recreational site. The probability of accepting this offer $\pi(t)$, given the individual's true (unobserved) valuation WTP is then:

$$\pi(t) = Pr(WTP>t) = 1-F(t) \tag{2}$$

where F is a cumulative distribution function of the WTP values in the population. In the logit model F(.) is the c.d.f. of a logistic variate and in the probit model F(.) is the c.d.f. of a normal variate. The specification of this model can be briefly illustrated for the case where the WTP values are assumed to have a logistic distribution in the population of interest conditional on the value of covariates. A statistical model is developed that relates the probability of a "yes" response to explanatory variables such as the bid amount, preferences, income, and other standard demand shifter type variables. The specific model is:

$$\pi(t;\tilde{x}) = [1 + \exp(-\alpha t - \tilde{\gamma}'\tilde{x})]^{-1} \tag{3}$$

where $\pi(t;\tilde{x})$ is the probability that an individual with covariate vector $\tilde{x}$ is willing to pay the bid amount t. The parameters to be estimated are α and $\tilde{\gamma}'$ (the constant term is included in $\tilde{x}$). The equation to be estimated can be derived as:

$$L = \ln[p/(1-p)] = \alpha t + \tilde{\gamma}'\tilde{x} \tag{4}$$

where L is the "logit" or log of the odds of a "yes" and p are observed response proportions. In application, the logit and probit models are so similar that it is difficult to justify one over the other on the basis of goodness of fit. We choose to work with the logistic specification here because the probit model does not lead to closed-form derivatives. Maximum likelihood estimates of the parameters in equation 4 can be obtained with a conventional logistic regression program. We have utilized SAS (SAS Institute 1988). Welfare measures include the mean, median or other percentiles of the estimated WTP distribution. Welfare measures and approaches for estimating the variance of these parameters are described in Duffield and Patterson (1991).

2.3 Pilot Survey

A number of activities were necessary in the first phase of this study in order to achieve our first objective: development of a final survey instrument for a detailed phone survey of 2500 Montana cattle and sheep ranchers. Secondarily, it was necessary to develop an agreement with the Montana Agricultural Statistics Service (hereafter "MASS") to implement this survey. The basic results of this work are provided in a set of documents appended to this report. Appendix E provides the final phone script provided to MASS and Appendix D is a mailing and "warmup" letter sent to all survey participants prior to telephone contact. Appendix A is a signed Memorandum of Understanding (MOU) between MASS and the Department of State Lands on how the survey will be implemented. Appendices B and C provide copies of the pilot survey and a brief summary of results. The following narrative describes these activities and results in greater detail.

In order to identify the most important factors determining private grazing leases, we developed a study team that included experts in the area of range management. The team included Dr. Brian Sindelar and John Hansen of Rangehands, Inc. and Jim Almond, a Billings area rancher. Brian Sindelar was a professor of range management at Montana State University for many years and is now a private consultant based in Belgrade, Montana. John Hansen works with Brian Sindelar in Rangehands, Inc. and holds a masters degree in range management from MSU. Jim Almond has a background of many years as an agricultural credit banker. He is on the National Cattlemans Association's finance committee and is now full-time manager of his family's ranch. We met with these individuals in Bozeman on June 11 and began to develop a pilot survey instrument that was finalized in late June.

For purposes of this survey, we chose to target a relatively small sample of about 30 individuals. The sample was chosen based on previous knowledge of the ranching community, but was stratified by region. The surveys were personally administered by Brian Sindelar and John Hansen and averaged about 45 minutes in length. The purpose was not to develop an extensive data base for purposes of statistical analysis, but rather to develop general information on the market for leases that could be used in developing a survey instrument for the Phase II survey. As noted, the pilot survey instrument is provided in Appendix B and a report describing the highlights (coauthored by Brian Sindelar and John Hansen) is in Appendix C. We did choose to code the answers and develop a small data base. Frequency distributions for all questions were provided in an earlier report (Bioeconomics, Inc. 1992A).

2.4 Phone Survey Design and Methods

Based on the result of the pilot survey, we developed a draft Phase II phone instrument. A meeting was held in Butte on August 18 to revise this draft and extensive revisions continued through phone and mail contact up to August 26. At this point MASS began participating in the survey design and development of a computer assisted telephone instrument (CATI) that was programmed in BLAISE software. The lead responsibility for this work was with Steve Susemihl of MASS, with participation by Jim Sands and Curt Lund.

The final phone survey instrument (Appendix E) is organized into six sections. The initial section (A) obtains information on land tenure (acres operated by category). Section B is general questions for tenants and provides operation or ranch-level information on type of operation, and number and type of leases. Sections C and E, which are up to 25 questions long, are the heart of the survey. In these sections (which address tenants and landlords, respectively), detailed questions are asked concerning the lease rates, terms, services and productivity of the specific leases (see Appendix E for details). The phone survey was designed so that this section was repeated, depending on the number and type of leases held. No respondent was asked to complete more than four lease arrangements. The priority for selection was: two largest private leases as a tenant; two largest public leases with the largest state lease selected first followed by the largest non-state; two largest landlord leases. Of course for the many respondents with no leases of any type, Sections C through E are skipped entirely.

Section F includes general questions on leasing for all respondents. The first question is intended to mimic the Agricultural Statistics Service's July cattle survey (Appendix F) question on the "reported" average charge for leasing in the respondents area. The remaining questions elicit attitudes toward public leases, state lease fees and competitive bidding (see Appendix E).

The desired initial contact sample for this survey was set at 2500. Based on previous surveys it is anticipated that only about half of the MASS cattle and sheep operators list will actually hold private leases. Given nonresponse and the nonleaseholder share this may lead to about 1000 lease holder respondents. A sample of 1000 was judged to be adequate to stratify the responses by subsamples across lease type, region, livestock type and major lease characteristics. The sample was drawn systematically from a list with all cattle and sheep ranchers on lists maintained by MASS and ranked by size of the operation.

2.5 Cooperative Agreement with Montana Agricultural Statistics

Parallel to the development of the survey instrument, it was necessary to develop an agreement with MASS to implement the survey. MASS was selected for this work because of their experience, high professional standards, credibility and capability of implementing a phone survey. Only through the use of CATI methods (where the data base is automatically constructed through the course of the surveys) can the tight time frame for this study be met. We met with MASS and State Lands personnel on May 22 to initiate the development of a formal MOU. This was finalized on August 26 (Appendix A.)

3.0 DATA COLLECTION

3.1 Survey Administration

The phone survey was administered by MASS, with most of the interviewing done out of their Helena office. Because of the scale of this survey, it was necessary to also involve approximately 20 enumerators from the Wyoming Agricultural Statistics Service. All contacts were, of course, with Montana ranchers.

An important design consideration was the decision to use a pre-survey mail contact to increase the response rate and provide respondents an opportunity to prepare for the survey by assembling records as necessary. This mailing was sent out on September 22. A total of 36 of the approximately 2500 mailings came back due to bad addresses or forwarding expired. The survey design effort culminated in a training session for 30 phone enumerators in Helena on September 24, and the survey began on September 28. The phone survey ended in early November and Bioeconomics was provided with an electronic data base on November 10.

3.2 Response Rates

The total sample for this survey was 2,465 Montana sheep and cattle ranchers (Table 3-1). The cooperation rate was 83.5% and the completion rate was 69.0% (see Table 3-1 for definitions). These response rates are high for a phone survey and indicate high quality survey administration and practices. Also, this subject is of critical importance to the respondents and would be expected to receive their interest and concern. We were concerned that many individuals might refuse to participate in a survey which provided confidential information on an emotional issue like grazing lease rates. However, the refusal rate was only 13 percent. We greatly appreciated the courtesy and patience of the many individuals who participated in the survey. MASS procedures ensured the complete confidentiality of responses; there is no way for us to associate an individual or an operation name with the survey responses.

Table 3-1. Grazing Lease Survey Completion Rate Statistics.

Category	Number	Percent
Potential Respondents		
Completed Interviews	1626	66.0
Refusals	321	13.0
Unable to Reach	410	16.6
Subtotal	2357	95.6
Disconnected Telephone	108	4.4
Total Sample	2465	100.0
Cooperation Rate[1]		83.5
Completion Rate[2]		69.0

1. Equals completed interviews/(completes+refusals).
2. Equals completed interviews/potential respondents.

4.0 RESULTS

4.1 Overview of Land Tenure and Lease Characteristics

In this and the following sections we summarize the main survey results. A comprehensive variable list is provided in Appendix K. Detailed statistics on many variables are provided in Appendix H-L.

In this section we provide an overview of land tenure and lease characteristics based on the ranching operation. Summary statistics for ranch acreages for survey respondents are shown in Table 4-1. Table 4-2 shows acreage figures only for those having acreages > 0. Figure 4.1, derived from Table 4-1, shows the distribution of land by tenure status for a typical operation in the survey.

Table 4-1. Ranch Acreages for Pooled Sample.

Variable	Min	Max	Mean	Median	N	% with 0 acres
Acres Owned	0	55000	2335.3	740	1555	5.2
Non AUM Acres Rented From	0	40000	698.3	0	1561	54.3
Acres Rented To	0	40000	93.7	0	1568	90.5
AUM Acres Rented From	0	180000	1631.5	0	1466	57.4
Acres Operated	1	228000	4486.4	1531	1553	0.0
Land in Farm	1	74000	2946.9	1156	1553	0.0
Acres of Cropland	0	9200	617.8	260	1536	12.4
Acres of CRP[1]	0	2500	84.8	0	1534	84.2

1. Conservation Reserve Program.

The average number acres operated was 4486; the median was substantially lower at 1531 acres. Ownership amounted to 2335 acres on average, half of the ranches owned less than 740 acres, and 5% of the those in the sample owned no land whatsoever. Leased land averaged 698 acres per rancher, although slightly more than half (54%) had no leased land in

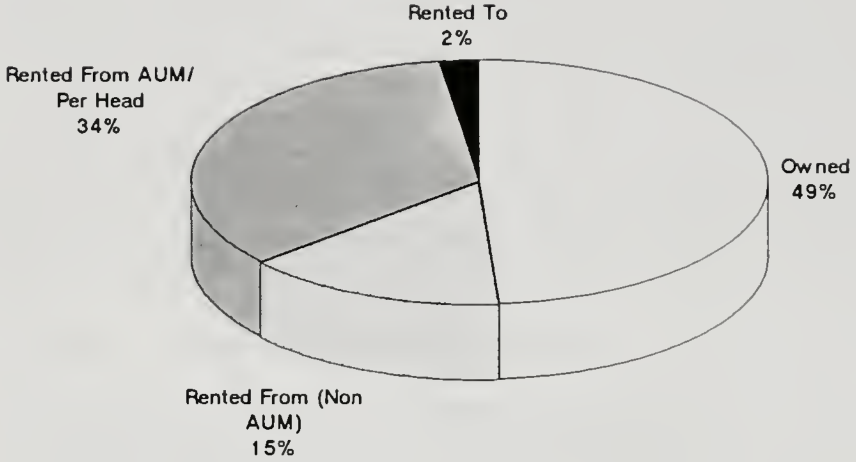


Figure 4-1. Average lease tenure distribution for all respondents.

the operation. Among those leasing land, the average number of acres leased was 1527 acres. One in ten rented out some land to others, averaging 986 acres. Most individuals had some cropland, averaging 617 acres per rancher. Conservation Reserve Program (CRP) acreage amounted to 85 acres per rancher, although 84% reported having no acreage in CRP. The average number of acres in CRP, among those participating in the program, was 537.

Table 4-2. Ranch Acreages for Individuals with Acres>0.

Variable	Min	Max	Mean	Median	N
Acres Owned	1	55000	2458.6	884	1477
Non AUM Acres Rented From	1	40000	1526.6	640	714
Acres Rented To	3	40000	986.4	270	149
AUM Acres Rented From	1	180000	3826.9	1000	625
Acres Operated	1	228000	4486.4	1531	1553
Land in Farm	1	74000	2946.9	1157	1553
Acres of Cropland	1	9200	705.6	350	1345
Acres of CRP[1]	3	2500	536.8	395	244

[1] Conservation Reserve Program.

Figures for those holding leases are shown in Table 4-3 and Figure 4-2. Possible lease categories included private leases, state leases, BLM leases, BIA leases, Forest Service leases, Landlord leases, and Grazing District/ Association ("Coop") leases. Landlord leases were simply private leases, but being leased out by a landlord respondent, rather than leased from another individual.

Overall, about two in three ranchers held a lease of some kind.The most common lease was private: 31% of all leaseholding ranchers held one private lease; 47% of all ranchers held one or more private leases. State leases were the second most frequently held: 33% of all leaseholding ranchers held one or more state leases. One quarter of the leaseholders held one or more BLM leases. Less frequent (<10%) were the Forest Service, BIA, and other leases.

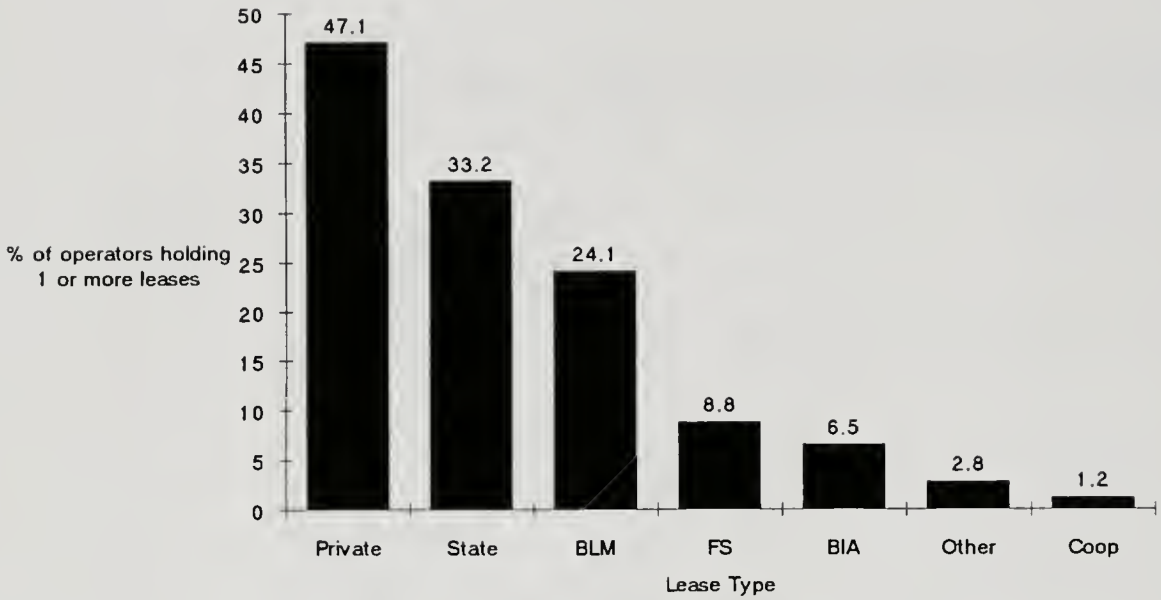


Figure 4-2. Leases held by lease type, % of respondents holding 1 or more leases.

Table 4-3. Number of leases held by ownership, expressed as % of those holding leases.

Number	Private	State	BLM	Forest Service	BIA	Other	Coop
0	52.6	66.8	75.9	91.2	93.5	97.2	98.8
1	31.0	24.5	20.2	7.7	4.6	2.6	1.1
2	10.4	4.4	2.5	0.7	1.0	0.2	0.0
3	3.9	1.8	0.8	0.1	0.4	0.0	0.0
4	1.3	0.8	0.3	0.1	0.4	0.0	0.0
5	0.2	0.4	0.1	0.2	0.0	0.0	0.0
6	0.2	0.7	0.1	0.0	0.1	0.0	0.0
7	0.1	0.2	0.0	0.0	0.0	0.0	0.0
8	0.1	0.2	0.0	0.0	0.1	0.0	0.1
9	0.2	0.2	0.0	0.0	0.0	0.0	0.0

Average figures for lease numbers and acreages for those holding a given lease are listed in Table 4-4. On the average, leaseholders held 0.77 private leases, 0.55 state leases, 0.31

BLM leases, 0.11 Forest Service leases, 0.11 BIA leases, 0.03 other leases, and 0.02 cooperative leases. For ranchers with private leases, the average total acreage for private holdings was 1869. Similarly, state leases average totals amounted to 1077 acres, BLM leases to 3198 acres, Forest Service to 7313 acres, BIA to 3916 acres, and other to 8044 acres.

Table 4-4. Mean lease numbers and acreages by lease type for those holding leases.

	Lease	n	Min	Max	Mean	Std Dev
Private	Number	692	0	9	0.77	1.06
	Acres	470	1	40000	1869	3596
State	Number	315	0	9	0.55	1.09
	Acres	350	20	20000	1077	1861
BLM	Number	229	0	6	0.31	0.63
	Acres	238	40	160000	3198	11574
Forest	Number	80	0	5	0.11	0.41
	Acres	53	50	60000	7313	11496
BIA	Number	83	0	8	0.11	0.52
	Acres	65	40	40000	3916	7469
Other	Number	14	0	2	0.03	0.18
	Acres	20	60	41000	8044	12551
Coop	Number	10	0	8	0.02	0.27
	Acres	10	22	12500	1748	3804

In the original dataset, 396 state leases were reported by respondents. Subsequent verification of these reported state leases with DSL leasing records showed only 315 of these to be valid observations for a variety of reasons (see Appendix N). About 17% of the reported state leases could not be located in DSL lease agreement records for the respondent. Other reasons included: no current agreement, not a grazing lease, or an annual lease situation. While the survey instrument was not intended to identify subleasing situations, it seems plausible that certain number of the respondents who reported having a state grazing lease but not listed as bona fide state leaseholders with DSL may have been involved in a subleasing situation. Other possible explanations include data entry error, or errors during data verification. Only those state leases which could be verified with DSL were considered in the analysis.

The vast majority of ranchers reported their operations to be primarily cow/calf (88.3%). Yearlings (2.7%), sheep and lambs (5.8%), hogs and pigs (0.5%), and other livestock (2.7%) made up the remainder of the ranching operations.

Leases classified by type of operation showed basically the same distribution. Cow/calf leases were most frequent (91.3%). Yearlings (2.4%), sheep and lambs (4.8%), hogs and pigs (0.1%), and other livestock (1.3%) made up the remainder of the operations.

Table 4-5. Type of Operations, by rancher and leases.

Operation	Ranchers		Leases	
	Number	Percent (%)	Number	Percent (%)
Cow/Calf	916	88.3	1381	91.3
Yearlings	28	2.7	36	2.4
Sheep and Lambs	60	5.8	72	4.8
Hogs and Pigs	5	0.5	2	0.1
Other Livestock	28	2.7	19	1.3

Other livestock operations reported by respondents included dairy, horse, angora goats, mink and beekeeping.

Although the majority considered their operations to be cow/calf, numbers of animals reported by ranchers appear to show that several in fact run mixed operations. For example, while only 5 individuals considered their operations to be hogs/pigs, 15 individuals had more than 100 hogs/pigs in the operation (Table 4-6).

Table 4-6. Distribution of Type of Operation by Size (# of Animals).

Number	Cow/calf	Yearling	Other Beef	Sheep	Hogs/ Pigs	Other
< 100	462	598	823	93	61	525
100-499	423	84	15	104	14	4
500-1000	52	11	0	30	1	0
> 1000	14	6	0	29	0	1

Animals reported in the 'Other' category, especially the < 100 group, tended to be from 1-10 horses but included llamas, chickens, angora goats, mules, donkeys, mink (> 1000).

Land type by ownership is shown in Table 4-7. Public leases were most often dryland (89%-99%); irrigated and sub- irrigated leases tended to be either private or BIA. Overall, subirrigated and irrigated leases were infrequent, but equally prevalent (4.5% and 5.4%, respectively). Ten percent (10%) of private leases were irrigated.

Table 4-7. Land type by Ownership.

Type of Lease	Dryland	Sub Irrigated	Irrigated
Private	82.5	7.5	10.0
State	96.8	2.6	0.6
BLM	99.1	0.9	0.0
Forest Service	96.1	2.6	1.3
BIA	88.9	3.7	7.4
Other	83.3	16.7	0.0
Landlord	100.00	0.0	0.0
Overall	90.1	4.5	5.4

4.2 Lease Rates and Terms

In this section we describe lease rates for each kind of lease. We first describe average lease rates by type of lease and by type of price (e.g. dollars/AUM, dollars/acres, by ranch and other). In the following section we discuss measures of differences across lease types in terms of services (such as who assumes costs for fence maintenance, herd management and water development) and productivity (such as weight gain and conception rates).

A total sample of 1524 grazing leases were studied from 868 leaseholders. Table 4-8 shows the distribution of leases by ownership. Almost half (46.2%) the leases were private, followed by 26.7% state, with most of the remainder being distributed among other public agencies. It should be noted that this distribution is not typical of statewide leasing, but rather an artifact of the sampling procedure, which selected preferentially for private and state leases. Of the private leases held, 16.3% of these were with a relative.

Table 4-8. Grazing Leases by Ownership.

Ownership	Number	Percent (%)
Private	692	48.4
State	315	22.1
BLM	229	16.0
Forest Service	80	5.6
BIA	83	5.8
Other	14	1.0
Landlord	16	1.1
Total	1429	100.0

Overall, the predominant basis for charging was the AUM (Table 4-9). For all leases pooled, the AUM was the basis for charging in 66% of the leases, followed by a per acre basis (11.4%), by the ranch (8.7%), other arrangements (8.4%), and per head (5.5%). Some small regional differences were apparent, notably in district 10 where by the ranch/other arrangements were frequent (15.4%, 17.3%), and district 30, where by the acre leases were common (20.9%).

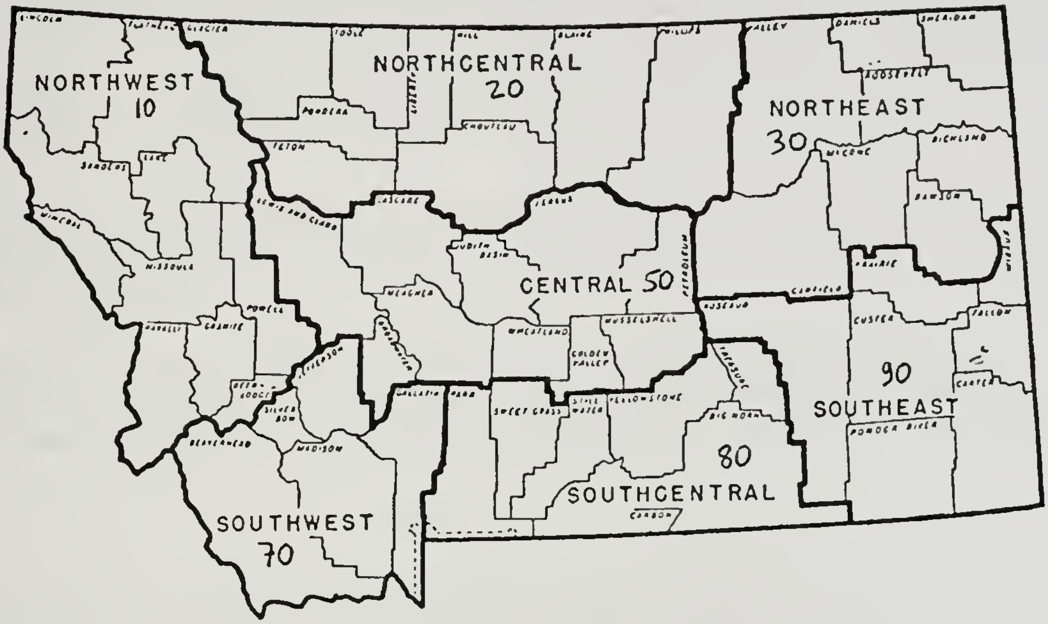


Figure 4-3. Montana Districts and Counties.

Table 4-9. Distribution of charge basis as a function of district, expressed in percent (%) of district leases.

Type of Charge	Dist 10	Dist 20	Dist 30	Dist 50	Dist 70	Dist 80	Dist 90	AVG
AUM	53.7	67.9	64.9	68.1	77.1	60.6	68.7	66.0
Per Head	7.4	6.1	4.9	5.3	4.5	6.1	4.4	5.5
By the Acre	6.2	13.0	20.9	8.0	3.8	10.0	14.1	11.4
By the Ranch	15.4	4.7	4.0	11.5	7.6	15.0	5.3	8.7
Other	17.3	8.4	5.3	7.1	7.0	8.3	7.5	8.4

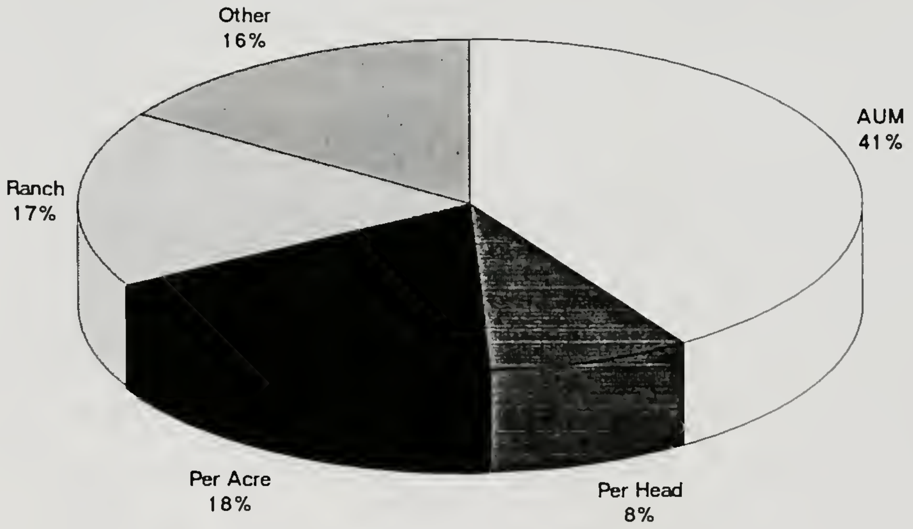


Figure 4-4. Distribution of charge basis for private leases.

For private leases, the basis for charging was similar to the overall figures, though somewhat more evenly distributed among the various categories (Figure 4-4). The AUM was the basis for charging in 41.1% of the cases, followed by per acre (17.9%), by the ranch (17.1%), other arrangements (15.7%), and per head (8.3%) .

State leases almost exclusively charged on an AUM basis (99%). Annual lease arrangements accounted for the remaining 1%.

BLM and Forest Service leases were generally charged on an AUM basis (90.0, and 94.7% respectively). Responses other than on an AUM basis may be questionable, or possibly indicate subleasing.

BIA leases were most frequently on an AUM basis (50.0%), although a substantial share (36.2%) were leased on a per acre basis. Per head accounted for 5.0%, and other arrangements 2.6%. Other leases (n=6) were mostly on an AUM basis.

Table 4-10. Distribution of charge basis by lease type.

Lease Type	AUM	Head	Acre	Ranch	Other
Private	41.1	8.3	17.9	17.1	15.7
State	99.0	0.0	0.0	0.0	1.0
BLM	90.0	5.0	2.3	1.4	1.4
Forest Service	94.7	2.6	0.0	0.0	2.6
BIA	50.0	5.0	36.3	1.3	7.5
Other	83.3	0.0	0.0	16.7	0.0
Landlord	57.1	21.4	21.4	0.0	0.0
Overall	59.9	5.7	13.5	10.2	10.7

Globally, an AUM averaged $6.70 independent of other factors such as land quality, district, ownership, etc. The median price was $8.00/AUM. Table 4-11 shows summary statistics for AUM rates by lease type:

Table 4-11. Summary statistics for AUM price by lease type.

Lease Type	Average	High	Low	Std Dev.	Sample (n)
Private	11.41	20.00	1.04	2.810	243
State	4.70	24.17	4.17	2.162	315
BLM	3.15	16.00	0.92	2.948	111
Forest Service	2.30	7.68	1.31	1.178	45
BIA	8.37	14.00	5.85	2.150	32
Other	5.35	9.25	3.00	3.401	3
Landlord	12.74	15.00	10.00	1.943	6
All Leases pooled	6.71	24.17	0.92	4.281	755

As anticipated, private leases were somewhat above the average, and public leases, substantially below the average. The differences in price for the different ownerships were statistically significant ($\alpha=.05$). Wide variation in lease prices was apparent for all ownerships.

AUM rates did vary somewhat between districts (Table 4-12). Factorial analysis showed that the effects of region, ownership, and the interaction of region and ownership were all statistically significant ($\alpha=.05$). District 50 (Central Montana: Broadwater, Cascade, Fergus, Golden Valley, Judith Basin, Lewis & Clark, Meagher, Musselshell, Petroleum, and Wheatland counties) was consistently the most expensive, and had the highest average AUM rates for Private, State, Forest Service, BIA, and Other leases. Least expensive was District 30 (Daniels, Dawson, Garfield, McCone, Richland, Roosevelt, Sheridan, and Valley counties), at $10.10/AUM. A breakdown of county by district code is found in Appendix G, and shown is shown above in Figure 4-3.

Table 4-12. Average AUM fees as a function of district and ownership.

Type of Ownership	Dist 10	Dist 20	Dist 30	Dist 50	Dist 70	Dist 80	Dist 90	AVG
Private	10.93	10.61	10.10	12.76	11.25	11.72	11.98	11.41
State	4.38	4.77	4.39	4.71	4.43	5.46	4.77	4.70
BLM	8.37	3.52	2.68	3.26	3.00	5.61	2.32	3.15
Forest Serv.	1.90	1.97	-	2.71	2.16	3.12	1.94	2.30
BIA	8.06	8.43	7.91	10.41	-	8.75	5.89	8.37
Other	3.80	-	-	-	6.13	-	-	5.35
Landlord	-	12.25	-	15.00	-	11.00	-	12.74

Globally, the average price per acre was \$7.51, and the median price was \$3.00/ac. Table 4-13 shows the per acre fees by lease type. No per acre leasing was present for Forest Service, state, or other leases. High average price for BLM leases is an artifact of small sample size (n=3) and one high observation (\$61.44/ac); these may in fact represent erroneous observations as BLM leasing is generally on an AUM basis. The BIA average is substantially lower than the private, although the median BIA lease is similar to that of the private and global at \$3.00/ac.

Table 4-13. Fees on per acre basis by lease type.

Lease Type	Average	High	Low	Std Dev.	Sample (n)
Private	4.56	30.00	0.50	5.43	80
BLM	21.85	61.44	2.00	34.289	3
BIA	4.93	16.00	1.50	4.466	23
Landlord	4.33	3.00	5.00	1.155	3
All Leases pooled	7.51	61.44	0.50	12.21	119

Leasing on a per head basis for yearlings was not frequently encountered. Private leases ranged from $3.33 to $13.00, and averaged $8.89 per head (n=15). Data was insufficient to provide estimates for other lease types.

Very few data were collected for per head basis leasing for sheep. Four individuals on private leases reported paying from $2.00 to $4.17/head, averaging $3.17.

Those individuals who reported paying on a per ranch basis averaged the equivalent of $1.93/acre for private leases (n=94).

Those individuals (n=159) reporting that they had other leasing arrangements generally were paying on a per year or flat fee basis. Many of these individuals held state leases, and believed that the basis for charging was not AUM, but rather on an annual basis. Other arrangements, especially for private leases included paying property taxes, barter, crop share, caretaker services, and free use.

4.3 Lease Services and Productivity

In this section we compare services and productivity across lease types. In general, private leases consistently provided the most in terms of services. The state provided the least of any public agency in terms of services. The Forest Service, and to some extent the BLM and BIA, tended to contribute materials or some combination of materials and labor.

Water Development

Landlord involvement in water development varied widely between ownership (Table 4-14). Landlords of private leases paid all of the costs in 25% of their leases. The BLM paid all costs in 11% of their leases. Other public agencies paid all costs in only 3-5% of the leases. Unlike the other lessors, the Forest Service frequently contributed materials (46%) for water development. The state contributed the least towards water development overall, contributing nothing towards water development in 95.5% of their leases.

Table 4-14. Water development participation of landlord.

Lease	Nothing	Materials	Labor	Material / labor	All costs	Other
Private	60.1	9.5	0.4	3.9	25.4	0.6
State	95.5	0.3	0.3	0.3	3.5	0.0
BLM	77.2	4.9	0.9	4.5	10.7	1.8
Forest Serv	40.3	45.5	5.2	3.9	5.2	0.0
BIA	85.5	2.5	0.0	2.5	4.9	4.9
Other	50.0	33.3	0.0	16.7	0.0	0.0
Landlord						
Overall	75.5	8.7	1.0	2.8	11.8	0.2

Fence Maintenance

Lessor participation in fence maintenance costs followed almost exactly the pattern of participation in water development costs (Table 4-15). The majority (75%) contributed nothing to fence maintenance costs. The State contributed nothing in 93% of state leases. The BIA and BLM were similar to the State in this respect, contributing to fence maintenance costs in less than 10% of the cases. Private, Forest Service, Other, and especially landlord (private) all contributed to fence maintenance in varying degrees; Private contributions were most frequently all costs (19%) or materials (15%), Forest Service contributed materials (13%), and landlords (ranchers renting out land) claimed to pay some combination of materials, materials and labor, or all costs in 71% of the cases (n=8).

Table 4-15. Fence maintenance participation of landlord.

Lease	Nothing	Materials	Labor	Material / labor	All costs	Other
Private	59.7	14.6	1.5	5.0	18.5	0.4
State	93.9	1.0	0.0	0.3	4.8	0.0
BLM	90.2	3.1	0.5	0.0	6.3	0.0
Forest Serv	76.3	13.2	2.6	1.3	6.6	0.0
BIA	91.4	3.7	1.2	1.2	2.5	0.0
Other	66.7	16.7	0.0	16.7	0.0	0.0
Landlord	28.6	21.4	0.0	14.3	35.7	0.0
Overall	75.6	8.6	1.0	2.8	11.8	0.2

Noxious Weeds

Overall, noxious weeds were reported to be a problem on 24% of all grazing leases in the study (Table 4-16). Forest Service leases had the by far the highest reported frequency of weed problems, with almost half (47%) of those holding Forest Service leases reporting noxious weeds to be problematic. The Other lease had the lowest rate at 17% followed by BLM at 19%. The remaining public leases had noxious weed problems approaching that of pooled average.

Table 4-16. Noxious weed problem on lease.

Lease	Weed Problem	
	Yes	No
Private	24.1	75.9
State	22.7	77.3
BLM	19.2	80.8
Forest Serv	46.8	53.3
BIA	23.5	76.5
Other	16.7	83.3
Landlord	21.4	78.6
Overall	24.0	76.0

4.4 Hedonic Price Model

Following the theory and methods described previously, a hedonic price model was estimated to explain private lease rates as a function of the measures of lease terms, services and productivity described in the preceding section.

As a first step toward selection of explanatory variables, simple univariate correlations between amount charged and 115 other continuous and categorical variables were estimated. These are found in Appendix L. The amount charged variable is of course stratified into 5 separate groups: AUM basis, Per head basis, Per Acre basis, Per Ranch, and Misc. basis categories. Since AUM's were the predominant basis for charging, emphasis was placed on this group for multivariate modeling.

A 2/3 sample fraction was randomly selected from the private leases and used to develop the hedonic price model. The model developed from this fraction was then tested against the remaining 1/3 fraction as a measure of robustness. Details of this validation are found in Appendix O.

The full and reduced model for private AUM lease rates are shown in Table 4-17. The full model included district variables to account for regional differences, service variables reflecting landowner participation in water development and fence maintenance costs, a variable for inholding status, a variable for land type (irrigated lease), a variable for lease terms (> 5 years), and a variable indicating whether the lease had been held for one year or less (see variable definitions, Table 4-18).

The reduced model explained AUM prices in terms of location (District 30, 50), services (fence and water development costs), land type (irrigation), lease terms (> 5 years), and whether the lease had been held for only one year (hereafter called "New Lease"). Inholding status, noxious weed problems, or presence in districts 10, 20, 70, or 80 did not have any predictive value. Predictive variables were generally significant at the 1% confidence level, with the exception of District 30, and New Lease, which were significant at the 10% level. Residuals (the difference between reported and model-predicted values) were normally distributed. More detailed results of analysis of variance, parameter estimates, and residuals for the hedonic model with the full sample size are summarized in Appendix H.

Table 4-17. Full and reduced hedonic AUM lease rate models.

Variable	Complete Model	Reduced Model
Intercept (t-stat)	10.336 (15.82)	9.548 (28.14)
District 10	-0.997 (-1.32)	---
District 20	-0.805 (-1.09)	---
District 30	-1.488 (-2.12)	-0.855 (-1.81)
District 50	1.055 (1.54)	1.60 (3.72)
District 70	-0.346 (-0.49)	---
District 80	-0.460 (-0.67)	---
Inholding	-0.409 (-0.77)	---
Noxious Weeds	-0.399 (-0.95)	---
New Lease	0.673 (1.68)	0.752 (1.95)
Terms	-1.900 (-2.49)	-1.94 (-2.58)
Fence Maintenance	1.432 (3.78)	1.437 (3.90)
Water Development	0.770 (2.04)	0.954 (2.66)
Land Type	2.123 (3.07)	1.747 (2.76)
Adj r^2	0.261	0.268
Sample (n)	217	219

Table 4-18. Variable definitions for hedonic price models.

DISTRICT 10-80= dummy variable 0/1, coded 1 if lease is located in a given district , 0 otherwise. See Appendix G for complete listing of counties/ districts.

WATER DEVELOPMENT= Landowner participation in water development costs. Dummy variable coded 1 if contribution 2,3,4,or 5, and 0 otherwise.

1) Nothing
2) Materials only
3) Labor only
4) Materials and some labor
5) All of the costs.

YEARS HELD= Dummy variable coded 1 if lease held for 1 year only, and 0 if lease has been held for more than one year. Derived from continuous variable as index of recently negotiated leases.

TERMS= Dummy variable coded 1 if lease terms are more than 5 years, and 0 if less than or equal to 5 years.

INHOLDING= Inholding status, coded 1 if lease is surrounded inholding, and 0 otherwise.

NOXIOUS WEEDS=Categorical variable, coded 1 if noxious weeds are a problem on the lease, or 0 if weeds are not a problem on the lease.

FENCE MAINTENANCE= Landowner participation in fence maintenance costs. Dummy variable coded 1 if contribution 2,3,4,or 5, and 0 otherwise.

1) Nothing
2) Materials only
3) Labor only
4) Materials and some labor
5) All of the costs.

LAND TYPE= Categorical variable, coded as dummy 1 if lease is irrigated, and 0 if subirrigated or dryland lease.

The model explained about 26.8% of the variability in lease prices. District 30 tended to be less expensive, and District 50 more expensive. All other things being equal, leases in District 30 were lower by -$0.86/AUM and District 50 was more expensive by

+$1.60/AUM. All other things being equal, lessor participation in services resulted in higher lease prices. Contribution to water development, either materials, labor, or a combination of costs added+$0.95/AUM. Similar participation in fence maintenance added +$1.44/AUM to the lease price. Irrigated leases added an additional $2.27/AUM to the lease rate. Recently negotiated leases, held one year only, were more expensive by $0.75/AUM, and leases with terms exceeding 5 years were less expensive by -$1.94.

One would expect many other variables such as inholding status, lease acreage, productivity, operating expenses, etc. to play a determining role in AUM lease prices. In fact, a number of these variables are individually correlated with lease prices, as seen in the univariate correlation matrix (Appendix L). These variables are not present in the multivariate model because they do not add any additional explanatory power to the model given the presence of district, water development, irrigation, the lease held one year variable, fence maintenance, and lease terms.

A frequency distribution of the reported private AUM lease rates and the AUM lease rates predicted by the hedonic model is shown in Figure 4-5. The model reproduces the distribution of private lease rates fairly well, although it tends not to predict extreme values, especially the lowest prices for private leases.

Tables of Appendix P provide detailed summary statistics for independent variables in the hedonic models for comparative purposes. Table 4-19 shows the simple hedonic variable means for private and state leases.

Table 4-19. Private and state lease hedonic variable means.

Variable	Mean	Mean
AUM Rate	11.33	4.74
District 30	0.152	0.195
District 50	0.190	0.144
Fence Maintenance	0.615	0.058
Water Development	0.554	0.041
Land Type	0.069	0.007
Terms>5yrs	0.048	0.825
New Lease	0.238	0.034

The model developed on a 2/3 sample fraction was tested against the remaining third as a measure of robustness. The means and ranges of predicted and reported values are shown in Table 4-20. Full details of the modeling are found in Appendix O.

Table 4-20. Reported and Predicted AUM prices for 1/3 test fraction (private leases).

Variable	Min	Max	Mean	Std Dev	n
Predicted	8.60	14.83	11.38	1.419	83
Reported-Pred[1]	-5.87	4.38	-0.12	2.014	83
Reported	4.00	15.00	11.26	2.276	83

1.Reported-Predicted= Average of the individual reported-predicted differences.

The hedonic model proved to be fairly robust; when tested against the 1/3 fraction, private lease rates were underpredicted by an average of \$0.12/AUM. Predicted and reported values for the 2/3 test fraction were moderately but significantly correlated. A regression of predicted on reported lease rates for the model had an adjusted r^2 of 22.6%, and was highly significant ($\alpha=0.01$).

While the variable "New Lease" was not significant in the 2/3 sample fraction multiple regression, it was included in the final reduced model and did prove statistically significant.

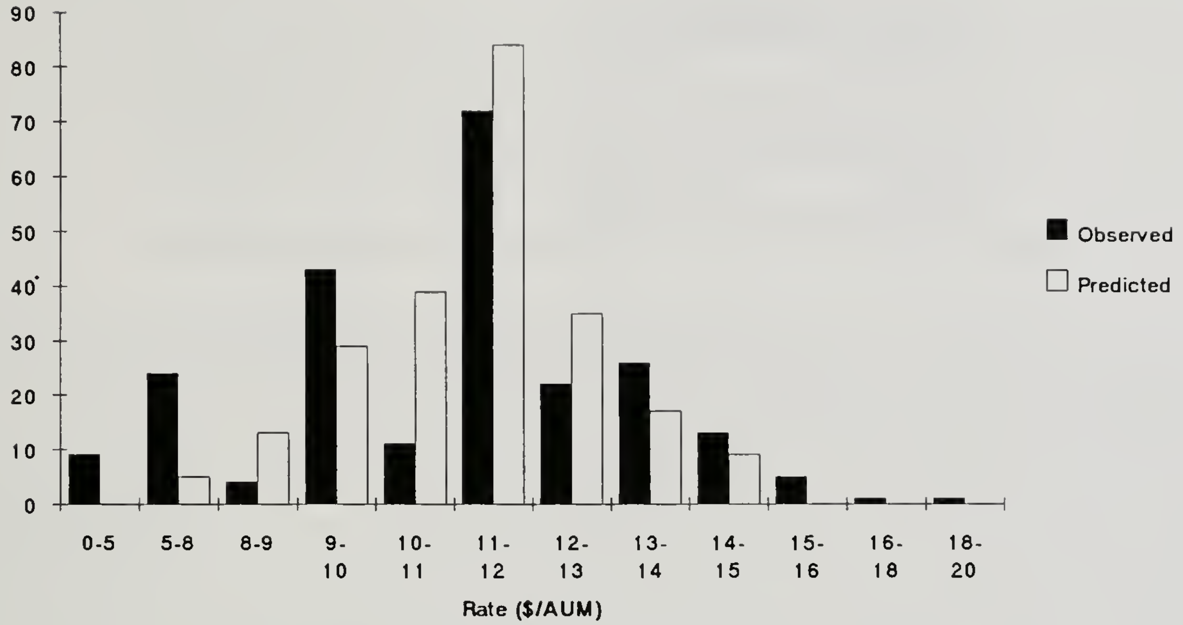


Figure 4-5. Distribution of reported and model predicted private lease rates.

4.5 Predicted Fair Market Prices

The hedonic model for AUM price derived from the private lease sample was used to predict AUM prices for state leases in the sample. Average figures for actual and predicted prices on state leases are shown in Table 4-21. Minimums, maximums, averages, and standard deviations are shown in Appendix I.

Both hedonic models indicate that state leases are generally underpriced relative to private leases of comparable quality. State leases averaged $4.74/AUM. The hedonic model predicted an average market value for state leases to be $8.16. This indicates state leases may be underpriced on the average by $3.42/AUM relative to the private lease market.

Table 4-21. Mean, actual and predicted AUM prices for state leases.

Variable	State
Predicted	8.16
Actual-Pred[1]	-3.42
Actual	4.74

1. Actual-Predicted= Average of the individual actual-predicted differences.

State lease prices were variable, though, ranging from $[illegible]17 to $24.17/AUM. While the majority of leases were priced at less or equal to the private market, 5.8% state leases were overpriced according to the model predictions.

Table 4-22 shows predicted fair market values and 95% confidence limits for state leases and selected state lease subgroups. The average predicted fair market value for state leases globally was $8.16/AUM (as above), with 95% confidence limits of $6.95 and $9.37, or ± 14.8%. Fair market value for a "typical" state lease (i.e. a lease with no services, dryland, 10 year terms and held more than one year: about 76% of state leases) was slightly below this global figure, at $7.69/AUM. Predicted values of state leases as a function of district ranged from a low in District 30 of $7.13/AUM, to a high of $9.56/AUM in District 50, and $8.16/AUM for leases in areas other than Districts 30 and 50.

Table 4-22. Predicted state lease fair market values for various subgroups.

Group	Mean	Std Err	Lower 95% Limit	Upper 95% Limit
All State Leases	8.16	0.614	6.95	9.37
"Typical" State Leases	7.69	0.737	6.23	9.14
District 30 State Leases	7.13	0.779	5.59	8.66
District 50 State Leases	9.56	0.728	8.12	10.99
Other District State Leases	8.16	0.602	6.98	9.35

Another means of corroborating model predictions of fair market values for state leases, though simplistic, is a direct comparison of state leases with the group of private leases most similar to state leases based on the set of hedonic variables. The group of private leases most similar to state leases would be those with the following characteristics: Dryland, long term, without fencing or water services, held by the leaseholder for long periods. Table 4-23 shows summary statistics for all private AUM grazing leases, the subgroup most resembling the state leases, and the subgroup of dryland private leases.

Table 4-23. Private lease AUM rates, global and subgroup like state leases.

Group	Min	Max	Mean	Std Dev	n
Resembling state	3.91	12.00	7.90	2.56	6
Dryland private	1.04	20.00	11.27	2.82	207
All private leases	1.04	20.00	11.41	2.80	243

The group of private leases (n=6) most closely resembling state leases averaged $7.90/AUM, as compared to $11.27 for dryland private leases, and $11.41 for private leases overall. This was slightly lower but close to the figure of $8.16/AUM predicted by the hedonic model for fair market value of state leases.

4.6 Competitive Bids on State Leases

In this section we describe the extent of competitive bidding for state leases based on estimates from the survey and State Land's files for all state grazing leases. We then examine some of the attitudes and practices concerning competitive bidding for our survey respondents.

Of the 315 state leases studied in the sample, 33 (10.5%) of these were competitively bid, with prices exceeding $4.17/AUM. Prices for these leases ranged from $4.19 to $24.17/AUM, and averaged $9.21/AUM. Table 4-24 shows summary statistics for the lease rate of competitively bid state leases, as well as variables present in the hedonic model of AUM lease rates.

Table 4-24 . Competitive state lease descriptive statistics for hedonic variables.

Variable	Min	Max	Mean	Std Dev	n
AUM Rate	4.19	24.17	9.21	4.73	33
District 30	0	1	0.09	0.29	33
District 50	0	1	0.21	0.42	33
Fence Maintenance	0	1	0.03	0.17	33
Water Development	0	1	0.03	0.17	33
Land Type	0	0	0.00	0.00	33
Terms>5 yrs	0	1	0.84	0.37	33
New Lease	0	1	0.03	0.17	32

An attempt was made to use the hedonic model developed in the previous section to explain lease prices for the small sample of competitive state leases. Results were inconclusive; competitive state lease prices did not appear to be a function of the hedonic variables of the private market model. It should be noted however that competitively bid leases were disproportionately located in District 50 (21% of competitive bid vs. 14% for all state leases [Appendix P]). Note that District 50 was the most expensive region for private AUM leases.

Appendix M provides a recent (Oct. 19, 1992) summary of statewide competitive bids on state grazing lands. Based on this data, the average competitive bid on grazing land is $8.34. Based on a listing for the same data for all state grazing leases, only about 8.2% of all leases have competitive bids. On 4,296,385 state acres leased for grazing, 322,019 acres are in leases that are competitive bid.

Estimated lease AUM values could be used to establish minimum bid prices for public leases. Several factors may require that this approach be modified. For example, leases which are surrounded inholdings may not have competitive bids. Another factor influencing a competitive bid pricing scheme is the fact that ranchers may avoid submitting competing bids out of consideration for a neighbor.

A breakdown of inholding and fencing status by lease type indicates that for public leases, and especially state and BLM, a significant proportion of inheld, unfenced leases do exist (Table 4-25).

Table 4-25. Inholding Status by Lease Type, AUM leases.

Lease Type	No	Yes	% Fenced
Private	83.5	16.5	75.6
State	64.1	35.9	21.4
BLM	65.0	35.0	18.8
Forest Service	88.9	9.7	42.9
BIA	85.0	15.0	16.7
Other	100.0	0.0	---
Landlord	75.0	25.0	50.0
All Leases pooled	73.1	26.6	32.3

The price models were developed from the private leases, which were surrounded inholdings in 17% of the cases. Thirty seven percent (36%) of state leases were reported to be surrounded inholdings. Private inholdings were fenced for 76% of the leases, while state inholdings were fenced in only 21% of the time. As 29% of the all state leases were unfenced, surrounded inholdings, one might expect this proportion of state leases to be unsuitable for competitive bidding. BLM leases were similar to state leases in this respect: one third (35%) of BLM leases are surrounded inholdings, and only 19% are fenced. BIA inholdings (15% of all leases) were fenced only 17% of the time.

Willingness of ranchers/neighbors to bid competitively is also a factor limiting the establishment of true market values. The results displayed in Table 4-26 confirm that ranchers hesitate bid against neighbors. In response to the hypothetical question "Suppose that there was a state lands grazing lease in your area that could work well in your livestock operation, but the lease is currently held by a neighbor. At the time of lease renewal, would you submit a competitive bid ?", the majority (55%) of all ranchers surveyed they would not submit a bid out of consideration for a neighbor, 16% said they might submit a bid, and only 22% said they would submit a bid. Those ranchers holding AUM leases were even less inclined to bid against a neighbor. Only 15% said they would submit a competing bid against a neighbor, and 63% said they would not compete.

Table 4-26. Would you submit competing bid ?

Would you	All Ranchers(%)	AUM holders (%)
Yes	21.8	15.8
Maybe	15.9	17.1
No	55.4	62.9
Other	3.2	1.7
Don't Know	3.6	2.6

4.7 Per Acre Leasing

In this section we look briefly at private per acre lease rates. Table 4-27 shows the distribution of reported private dryland per acre rates for three groups: all dryland per acre leases, and per acre leases most resembling a "typical state lease". A "typical" state lease, defined in terms of hedonic model variables, would be dryland, no fencing or water development services, and lease terms either > 5 years, or > =5 years. Two levels of lease terms were selected both to show the effect of lease terms on rates, and to represent the two levels of lease terms generally associated with state leases (i.e. 5 or 10 years).

Table 4-27. Reported private per acre lease rate frequencies and percents.

Rate ($/acre)	Frequency, (%)		
	All Private	Resembling State Terms > =5 yrs	Terms > 5 yrs
0.50	1 (1.3)		
0.67	1 (1.3)		
0.78	1 (1.3)		
0.90	1 (1.3)		
1.00	6 (7.8)	1 (4.8)	1 (12.5)
1.12	1 (1.3)	1 (4.8)	1 (12.5)
1.20	1 (1.3)	1 (4.8)	
1.25	1 (1.3)		
1.50	4 (5.2)	1 (4.8)	1 (12.5)
1.80	1 (1.3)		
1.90	1 (1.3)		
2.00	14 (18.2)	7 (33.3)	4 (50.0)
2.50	7 (9.1)	2 (9.5)	1 (12.5)
3.00	11 (14.3)	4 (19.0)	
3.12	1 (1.3)		
3.25	1 (1.3)		
3.50	3 (3.9)	2 (9.5)	
3.63	1 (1.3)		
4.00	3 (3.9)	1 (4.8)	
5.00	1 (1.3)		
7.00	1 (1.3)	1 (4.8)	
8.00	3 (3.9)		
10.00	3 (3.9)		
11.00	1 (1.3)		
11.90	1 (1.3)		
12.00	2 (2.6)		
14.00	1 (1.3)		
14.30	1 (1.3)		
15.00	1 (1.3)		
30.00	1 (1.3)		

Table 4-28 shows summary statistics for leasing rates of the three groups in Table 4-27 above. Lease rates averaged $1.77/acre for the group of private leases most resembling state leases, and with terms > 5 years. Including those leases with 5 year terms increased the sample size from 8 to 21, and the mean increased to $2.56/ acre. Overall, private dryland leases averaged $4.20 per acre, although the median was only $2.50/acre.

Table 4-28. Summary statistics for private per acre lease rates.

Group	Min	Max	Mean	Median	Std Dev	N
Dryland per acre	0.50	30.00	4.20	2.50	4.68	76
Resembling State						
Terms> =5 yrs	1.00	7.00	2.56	2.00	1.30	21
Terms> 5 yrs	1.00	2.50	1.77	2.00	0.51	8

Productivity and forage quality were ranked by the respondent on a scale of 1 to 4, with 1=excellent, 2=good, 3=fair, and 4=poor (see Appendix E, Section C, questions 17 & 18). Results of this ranking for the dryland private lease group, private leases resembling state subgroup, and true state leases are shown in Tables 4-29 and 4-30.

Table 4-29. Respondent ranking of lease productivity.

Group	Frequency, (%) Excellent	Good	Fair	Poor	Mean[1]	Std Dev[1]
Dryland Private	17 (16.0)	56 (52.8)	25 (23.6)	8 (7.5)	2.23	0.81
Resembling State						
Terms > 5 yrs	1 (11.1)	5 (55.6)	3 (33.3)	0 (0.0)	2.22	0.67
Terms > = 5 yrs	3 (14.8)	15 (55.6)	7 (25.9)	2 (7.4)	2.30	0.78
True State	30 (9.6)	138 (44.4)	106 (34.1)	37 (11.9)	2.48	0.83

1. calculated from ranking with excellent=1, good=2, fair=3, poor=4.

Table 4-30. Respondent ranking of forage quality.

Group	Frequency, (%) Excellent	Good	Fair	Poor	Mean[1]	Std Dev[1]
Dryland Private	12 (11.3)	64 (60.4)	26 (24.5)	4 (3.8)	2.21	0.69
Resembling State						
Terms > 5 yrs	1 (11.1)	6 (66.7)	2 (22.2)	0 (0.0)	2.11	0.60
Terms > = 5 yrs	4 (14.8)	16 (59.3)	6 (22.2)	1 (3.7)	2.15	0.71
True State	22 (7.1)	174 (55.9)	94 (30.2)	21 (6.8)	2.37	0.71

1. calculated from ranking with excellent=1, good=2, fair=3, poor=4.

Lease productivity on dryland per acre private leases averaged 2.23, or between good and fair, closer to good (Table 4-29). For the private leases resembling state, productivity is very similar, averaging 2.22 for the group with terms > 5 years, and 2.30 for the group with terms > = 5 years. Lease productivity on true state leases averaged 2.48, or almost exactly between good and fair.

Forage quality on dryland per acre private leases averaged 2.21, or between good and fair, closer to good (Table 4-30). For the private leases resembling state, forage quality is very similar, averaging 2.11 for the group with terms > 5 years, and 2.15 for the group with terms > = 5 years. Forage quality on true state leases averaged 2.37, and approached the midpoint between good and fair.

In general, lease productivity and forage quality were not greatly different for the various subgroups of dryland private per acre leases and true state AUM leases. The average per acre rate for these different subgroups of private per acre leases ranged from $1.77 to $2.56/acre, with medians of $2.00. State leases charged on an AUM basis, being of similar forage quality and productivity, might be expected to return values close to $2.00 per acre of leased land. In fact, the total revenue on state grazing leases for the fiscal year ending June 1992 was $4,341,521 (see Appendix M). For the 4,296,385 acres of state grazing lands, this averages $1.01 per acre. State AUM grazing lands thus would appear to be underpriced by about half from this perspectiveFebruary 1, 1993.

4.8 Leasing on a Per Ranch Basis

In this section we look very briefly at leasing on a "per ranch" basis. The objective was mainly to derive a per acre value for comparison with the per acre values reported in the preceding section 4.7. The per acre lease rates derived from the reported lease (ranch) acreage and yearly lease fee are shown in Table 4-31. As in the previous section, leases are broken down by lease characteristics similar to state leases, i.e. dryland, no fencing or water development services, and lease terms either > 5 years, or > =5 years.

The derived $/acre rates are quite similar to the $/acre rates of the previous section. The group most resembling state leases (terms > 5 years) averaged $2.26/acre, and the median was $1.66/acre. The group with terms >= 5 years was slightly higher at about $2.62-$2.65/acre. Overall, the dryland/ no services rate averaged $3.42/acre, or $2.50/acre median. These values would appear to lend some additional support to the assertion that the per acre value of private dryland / no service leases may be in the neighborhood of $2.00/acre.

Table 4-31. Summary statistics for per acre lease rates derived from private per ranch leases.

Group	Min	Max	Mean	Median	Std Dev	N
Dryland per acre	0.02	15.63	3.42	2.50	3.61	61
Resembling State						
Terms>=5 yrs	0.05	7.50	2.62	2.69	2.20	15
Terms> 5 yrs	0.06	7.50	2.26	1.66	2.43	8

4.9 Recreational Access

In this section we discuss our findings concerning recreational access and use on the grazing leases in our sample. The discussion is with reference to questions 22-25, Section C and corresponding questions in Section E (Appendix E).

Leaseholders were surveyed about the status of recreational access and use. State parcels were evenly split between those having experienced some hunting or fishing use in years previous to the survey, and those not experiencing recreational use (Table 4-32).

Table 4-32. Hunt/ Fish prior years.

Response	Percent (%)
Yes	50.1 (174)
No	49.9 (173)

Recent status of public access on State parcels tended to be open (48.6%), followed by access by permission (45.7%). A small number (5.8%) reported a block management, generally closed, or other situations (Table 4-33).

Table 4-33. Recent status of public access.

Response	Frequency %, (n)
Open	48.6 (84)
By Permission	45.7 (79)
Block Management	1.7 (3)
Generally Closed	2.9 (5)
Other	1.2 (2)

Legal access existed for slightly over half (55.5%) of the State grazing leases (Table 4-34).

Table 4-34. State parcel legally accessible.

Response	Frequency %, (n)
Yes	55.5 (195)
No	44.5 (351)

Slightly fewer than one third of the state leaseholders reported this year to be the first for public access (Table 4-35).

Table 4-35. First year for public access.

Response	Frequency %, (n)
Yes	30.1 (28)
No	67.7 (91)

Respondents holding public leases were asked if they would be willing to pay an additional amount (from $1.00 to $5.00/AUM) for the right to control public access to the lease. Wiilingness to pay decreased with increasing bid amount, from 29% responding "yes" at $1.00/AUM to 5.3% saying "yes" at an additional $5.00 AUM (Table 4-36). The results of the logit analysis are found in Appendix Q. Mean net willingness to pay was $1.13, and the median was $0.52.

Table 4-36. Willingness to pay to control public access, bid ($/AUM) and responses.

Bid ($)	Frequency	n,%
	Yes	No
1	37	90
	29.1%	70.9%
2	27	86
	23.9%	76.1%
3	19	116
	14.1%	85.9%
4	9	123
	6.8%	93.2%
5	6	107
	5.3%	94.7%

The majority (57%) of respondents holding private leases did not have control of public access (Table 4-37). Of the minority of leaseholders having control of public access, the majority (81.2%) allowed public access for hunting or fishing (Table 4-38). Access was generally free of charge (88.2%), although 3 respondents (1.3%) charged a fee, 7 (2.9%) subleased to an outfitter, 6 (2.9%) allowed access under block management, and 12 (5.0%) reported another arrangement, generally access by permission (Table 4-39). A little more than half (59%) of those leasholders not controlling access reported that the landlord did allow hunting or fishing access to the lease (Table 4-40). Generally, the landlord allowed free hunting and fishing (84%), although 4.9% charged a fee, 2.2% subleased to an outfitter, and 7.7% had some other arrangement (4-41).

Table 4-37. Leaseholder control of public access, private leases.

Response	Frequency %, (n)
Yes	43.2 (294)
No	56.8 (386)

Table 4-38. Leaseholder allows public access, private leases.

Response	Frequency %, (n)
Yes	81.2 (238)
No	18.8 (55)

Table 4-39. Access permitted by leaseholder.

Public Access	Frequency %, (n)
Hunt/Fish for free	88.2 (210)
Charge a fee	1.3 (3)
Sublease to Outfitter	2.9 (7)
Entry under Block Mgt.	2.6 (6)
Other	5.0 (12)

Table 4-40. Landlord allows public access, private leases.

Response	Frequency %, (n)
Yes	59.2 (196)
No	40.8 (135)

Table 4-41. Access permitted by landlord.

Public Access	Frequency (%), n
Hunt/Fish for free	84.1 (64)
Charge a fee	4.9 (9)
Sublease to Outfitter	2.2 (4)
Entry under Block Mgt.	1.1 (2)
Other	7.7 (14)

4.10 Attitudes toward Public Leases

In this section we discuss responses to questions asked of all survey respondents regarding attitudes toward public leases and feelings about "fair market price" for state leases.

General questions concerning leasing were asked of all respondents. As noted previously in section 4.2, ranchers asked about the most common basis for charging on private, non-irrigated grazing land in their area generally responded (63%) that AUM was the standard. Among those holding AUM based leases, 84.3% thought AUM was the standard basis for charging their area. Respondents were asked to estimate the going rate for non-irrigated private grazing leases in their area (Appendix E, Section F). Figure 4-6 shows the distribution of going rates reported by ranchers. The most frequent figure quoted as the going rate for private leases was $12.00/AUM, both by all ranchers and AUM leaseholding ranchers. The average reported going rate for all ranchers (n=764) was $12.02, with a standard deviation of 2.625.

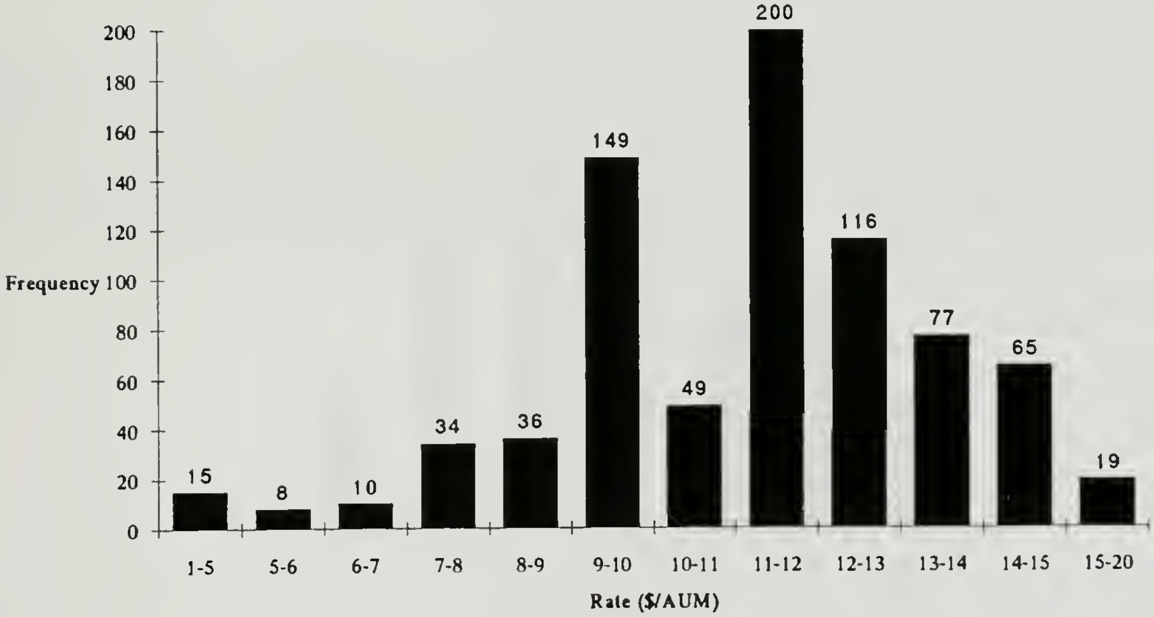


Figure 4-6. Reported going private AUM lease rates.

When asked if a fair price for State grazing leases would be equal the to price they quoted as the going rate for private, non-irrigated grazing leases, one third (34%) answered "yes". A large proportion of ranchers thought that state leases should priced below market value for private leases; those responding "no" were asked what a fair price for state school trust lands would be as a percent of the going rate quoted for private leases (with comparable terms and services). Respondents most frequently said that state leases should be 50% of the going AUM rate on private ground. Reasons given for lower State lease prices were generally related to differences in services and improvements such as fencing, water, and weed control (despite the comparable terms and services clause of the question). Next frequent were those who said state land was of poorer quality, lower forage quality, etc. Other reasons infrequently cited were public access problems, state lands belong to the people and should be priced cheaply, politics/regulations hassles, grazing already unaffordable, and various protest responses.

Figure 4-7 shows the distribution of respondent-estimated fair market value of state leases for all respondents and the subgroup of repondents indicating that state leases should be priced lower than comparable private leases. Table 4-42 shows summary statistics for these two groups, and the subgroup of individuals saying state grazing leases should be priced below market.

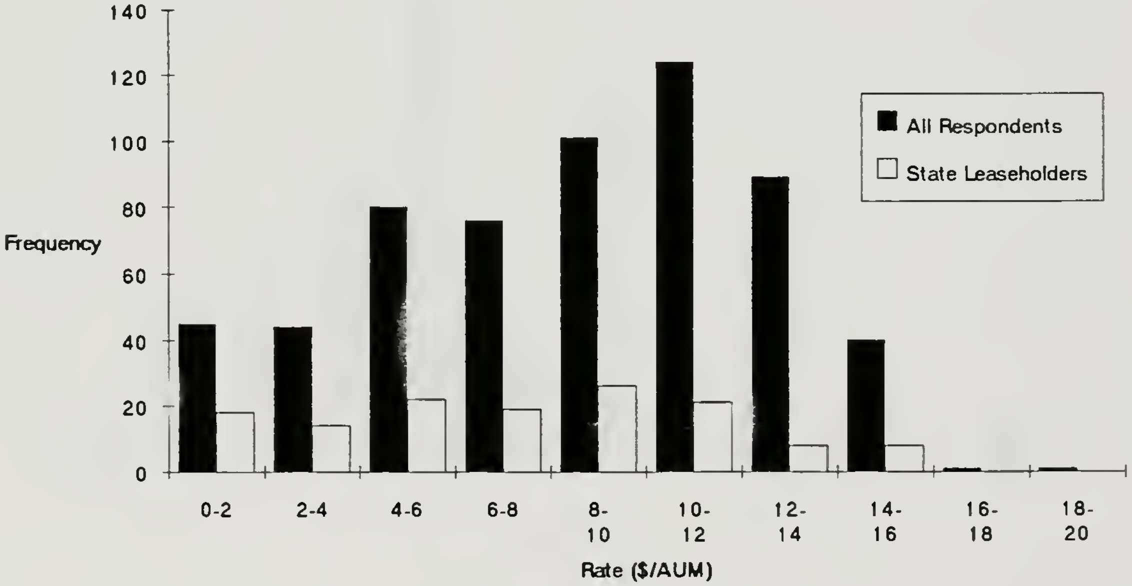


Figure 4-7. Respondent-estimated fair market value for state leases

Table 4-42. Fair market values for state leases as estimated by all respondents, the subgroup holding state leases, and the subgroup responding that state leases should be below market.

Group	Min	Max	Mean	Median	Std Dev	N
All respondents	0.06	20.00	9.01	10.00	4.10	601
State leaseholders	0.10	16.00	7.62	7.20	4.11	137
State < market	0.06	14.85	6.22	6.00	3.39	302

The average fair market value of state leases based on all responses by all individuals partcipating in the survey was $9.01/AUM. The subgroup of respondents holding state leases suggested $7.62/AUM as a fair market value, and the subgroup saying that state leases should be priced below market suggested a fair price of $6.22 on average. These fair market values suggested by the ranching community are all higher than than the $4.17/AUM price for non competitive state leases. The $9.01/AUM average derived from all respondents is close to the $9.21/AUM average for competitively bid state leases in the sample. The estimate of fair market value of state leases as judged by state leaseholders in the survey was $7.62, which is less than but close to the $8.16/AUM figure predicted by the hedonic model.

Regarding the relative desirability of the different types of leases (question 3, Section F, Appendix E), all things being equal, private leases were the most desirable, followed by State and then Federal leases (Table 4-43). Over half (52.2%) ranked private best, 11.8% ranked State best, and 11.5% ranked Federal leases best. More than half (52.6%) ranked Federal leases worst, 9.8% ranked State worst, and 13.1% ranked private worst. One in four ranchers did not express an opinion about lease desirability.

Table 4-43. Ranking of lease desirability by lease type.

Rank	Percent (%)
Federal Best, State so-so, Private worst	9.7
Federal Best, State worst, Private so-so	1.8
Federal so-so, State best, Private worst	3.4
Federal so-so, State worst, Private best	8.0
Federal worst, State best, Private so-so	8.4
Federal worst, State so-so, Private best	44.2
Don't Know	24.6

The preference of private to public, and especially federal leases can be explained in terms of a number of factors including lease terms and land quality. The pilot survey (see Appendix C. Part 9, pg. 3) showed that the negative aspects of public leases included restrictions on use, public access, flexibility/negotiability, and land quality. Positive aspects of public leases were price, lease renewal, and length of lease. Private leases, on the other hand, had price as a negative, along with lease renewal and length of lease. Private leases were viewed positively for absence of restrictions, control of public access, flexibility/negotiability, and land quality. Clearly, the negative aspects of public leases, especially federal, far outweighed the positive when ranked against private leases.

4.11 Comparison to July Cattle Survey

In this section we compare our survey responses concerning private market lease rates to the MASS annual July Cattle Survey (Appendix F). Historical results for this survey for both Montana and western states is provided in Table 4-44.

Table 4-44. AUM lease rate history, July Cattle Survey.

Year	Western States		Montana	
	Lease Rate	Beef Price	Lease Rate	Beef Price
1969	3.82	27.00	no data	
1970	4.05	29.50		
1971	4.06	29.50		
1972	4.17	36.80		
1973	4.57	43.00		
1974	5.82	39.20		
1975	5.75	35.20		
1976	6.37	36.10		
1977	7.06	36.00		
1978	7.11	47.60		
1979	7.53	64.90		
1980	7.88	64.20	10.52	58.00
1981	8.83	59.10	11.30	51.90
1982	8.36	57.70	10.67	48.20
1983	8.85	56.40	11.12	48.00
1984	8.86	57.79	11.28	47.20
1985	9.17	53.65	10.63	47.60
1986	8.50	51.78	9.35	49.30
1987	8.54	59.96	9.52	61.10
1988	8.75	65.46	11.30	65.70
1989	8.87	67.46	11.35	68.20
1990	9.22	71.81	11.46	70.60
1991	9.66	72.15	12.13	69.80

Note: The western states private grazing lease rate series is from the U.S. Department of agriculture (1992) and is for an "Animal Unit" plus cow calf rates with cow-calf converted to AUM using: (1 AUM =cow-calf * 0.833). The Montana lease rate data is for a cow-calf pair AUM and is from Montana Agricultural Statistics Service.

AUM lease rates in Montana have generally been above $10.00 since 1980-1991, and have

averaged $10.89 during this same period. The average private lease rate observed in the present study was $11.41, very close to the reported 1991 July Cattle Survey figure of $12.13. The figure of $12.00/AUM was also the most frequently quoted in response to the survey question asking ranchers what the going AUM rates in their area were, and the average for all ranchers (n=764) was $12.02, with a standard deviation of 2.625. This $12.00/AUM rate was quoted both by those holding private leases and those without private leases.
This comparison provides some validation for the private lease rates obtained in this survey.

Note that in Table 4-44 we also report historical beef prices. We have examined the correlation of AUM lease rates to these prices. This relationship is examined here because beef prices are used in the Montana lease formula (see Section 1.2 above) to keep lease prices current.
Two models were applied to the western states and Montana time series. The first model was a simple linear regression of AUM lease rate on beef price, and the second model was a lagged model, where

AUM lease rate was regressed on beef price at time t, t-1, and t-2. The lagged model helps explain lease rates in terms of changes in beef prices over a three year period by adding two previous years' beef price observations to the simple linear model. Time-lagged models can help explain delayed responses of one variable to another.

Both the simple and lagged models for the western states data 1969-1991 showed that AUM lease rates varied with beef price (Tables 4-45, 4-46). In the simple regression, beef price explained 77% of the variability in AUM lease rates. The lagged model was marginally better, explaining 85% of the total variance. Note that the lagged variable t-1 did not help explain lease rates; lease rates were a function of current beef price, and more significantly, beef price two years previously.

Unlike the relationship observed in western states from 1969-91, Montana AUM lease rates did not vary in concert with beef prices from 1980-1991. For the simple regression, only the intercept was significant at the 5% level, and the regression is not statistically significant. The lagged model did not help explain changes in lease rates.

It should be noted that data for Montana was only available beginning 1980. When the same analysis is applied to the western states data for the equivalent time period, 1980-1991, the results are similar to the Montana data. The simple regression shows that the correlation between lease rate and beef price is not statistically significant. Thus, beef prices did not help explain changes in AUM rates in the west from 1980-1991. The lagged model for western state data 1980-1991 does perhaps indicate some correspondence between lease rates and beef prices two years previously, although this correlation is not significant at the 5% level. Thus, both in Montana and western states, AUM lease rates have been largely independent of beef prices from 1980-1991.

Table 4-45. Simple regressions of lease rate on beef price.

Variable	Western 1969-91	Western 1980-91	Montana 1980-91
Intercept	1.106	6.84	8.90
(t-stat)	(1.513)	(5.084)	(6.312)
Beef Price	0.121	0.032	0.035
	(8.682)	(1.476)	(1.427)
Adj r^2	0.77	0.10	0.09
Sample (n)	23	12	12

Table 4-46. Lagged regressions of lease rate on beef price.

Variable	Western 1969-91	Western 1980-91	Montana 1980-91
Intercept	0.937	4.63	8.75
(t-stat)	(1.451)	(3.002)	(5.959)
Beef Price (t-0)	0.060	0.024	0.027
	(1.997)	(0.710)	(0.993)
Beef Price (t-1)	-0.018	-0.005	0.018
	(-0.397)	(-0.118)	(1.116)
Beef Price (t-2)	0.090	0.051	-0.007
	(3.037)	(2.070)	(-0.554)
Adj r^2	0.85	0.31	0.02
Sample (n)	23	12	12

Note that in sampling our private market leases, we gave a priority to first sampling the largest leases. This could introduce a bias in an unknown direction into our estimated lease rates and will bias average lease size upward. We expect the bias, if any, on lease rates to be slight because most respondents reported only one (if any) private lease. We examined the correlation of lease rates to size of lease and found that lease rates and lease acres were not correlated for private leases in our sample. However, higher lease rates were weakly but significantly correlated to lease size for all leases pooled (see Appendix L, Univariate correlations). The Pearson r was -0.137, $\alpha=0.05$, thus higher lease rates were associated with smaller lease acreage.

5.0 INTERPRETATION

5.1 Current Montana Policy

The main features of the current Montana policy toward grazing leases on state school trust lands were described previously in Section 1.2. Important features of that policy include minimum bids based on six times the previous year's beef price, and preference rights for renewal. The factor of "six" is based on an expectation of 50 pounds weight gain per AUM, a "fair" landlords share of the land's share of production of 30% and an estimate of 40% of production being due to the land resource. Combined, the latter shares make 12% of 50 or 6.

The results of this policy are that, in the current year, the minimum price per AUM is $4.17 (six times a beef price of $0.695/lb). Over 90% of all leases are at the minimum rate. Only about 8 percent of all leases are competitively bid; the average of the latter is $8.34. We estimate that the average value per AUM for all state grazing leases is about $4.24. This is derived by dividing the total revenue on state grazing leases for the fiscal year ending June 1992 at $4,341,521 by the 1,023,200 total AUMs in the lease contracts. A return per acre can also be calculated by dividing the total grazing revenues by the total acres leased for grazing (4,296,385) or $1.01 per acre.

5.2 Policy Alternatives

There are a number of alternatives to the current policy. Within the existing formula approach, one could examine: different minimum bid, a different factor than "six" to multiply times beef price, and the use of beef prices to keep the AUM price current. The beef price component in the state's AUM price formula keeps AUM prices current in the sense that beef prices change from year to year and include the long term effects of overall price inflation in the economy. Examining grazing management policies in other states suggests other possible alternatives: dropping the preference right to encourage competitive bidding, and leasing on a dollar per acre rather than dollar per AUM basis.

5.3 Interpretation of Survey Results

In this section we examine the policy alternatives for grazing lease management on Montana state lands based on the analysis of our survey results in the preceding Section 4. Our main focus is on alternative approaches to estimating fair market value for state grazing leases. Table 5-1 summarizes six alternative approaches. Each of these will be discussed in turn.

Our first approach is based on a statistical model (a so-called "hedonic model") that relates lease characteristics and terms to price for private market grazing leases. Lease characteristics that could influence price include the term (number of years) of the lease, whether the lease is a newly held lease, provision of fencing maintenance and other services by the landlord, whether the lease is irrigated or dryland and region the lease is located in (e.g. central versus northeast Montana). The latter factor is included to account for differing market conditions across the state.

This model was estimated based on our sample of dollar/AUM private market leases. The model has a number of statistically significant parameters with the theoretically expected signs. For example, other things equal, if the landlord provides fence maintenance services, the tenant pays an AUM price that is about $1.50 higher on average. Similarly, leases with a term of greater than five years are worth about $2.00 less on average. Lease rates were significantly higher (almost $2.00) in central Montana counties such as Cascade; by contrast lease rates were about a dollar lower in the north central and northeast. This model was used to predict the market value of leases with characteristics similar to the typical state lease (no landlord provided fencing or water development services, terms greater than five years, not newly held, and dryland). For the "typical" state lease the specific estimate of fair market value is $7.69. Based on the estimated confidence interval for this predicted value, one can be 95 percent sure that the true mean is between $6.23 and $9.14. This range reflects the uncertainty in the parameters of the model and how close the values of the explanatory variables used in the prediction are to the means of these variables in the sample of private leases.

We also provide in this report region specific prices based on our finding of significantly higher prices in central Montana and significantly lower prices in northeast Montana. For region specific prices the hedonic model predicts a central Montana price of $9.56, a northeast Montana price of $7.13 and a "rest of the state" price of $8.16.

These prices based on the hedonic model are somewhat lower than the average market price because state leases are less likely to be on irrigated land and generally offer much lower levels of landlord services with regard to fencing and water. Additionally, state leases are much more likely to have been held for more than one year and are for a longer term.

Another way to estimate fair market prices (Table 5-1) is to look at the average price of the private leases that are most like the state leases. The subsample of private AUM leases with term greater than 5 years, no fence maintenance services, and dryland only is $7.90. This is based on a small sample of six leases with the specific values of $3.91, $7.50, $8.00, $8.00, $8.00 and $12.00.

A third way to estimate a market value of state leases is to look at the average competitive bid for the 8% of all leases which are competitive bid. As discussed earlier in this report, leases which are competitively bid are not significantly different from other state leases regarding services and land type. The average competitive bid for state leases is $8.34, based on a sample of all 613 competitively bid state leases.

A fourth approach is to look at what ranchers report is a fair price for state leases. A total of 601 respondents gave us an AUM-based average price for private leases in their area and the percent of that average private lease rate that they thought represented a fair price for state leases. The percent-weighted average is $9.01. The subsample of respondents to this question who hold state leases have an average percent-weighted fair price of $7.62.

A fifth approach is to examine what other public land management agencies charge for private grazing leases. BLM and Forest Service lease rates are set by formula (at $1.92 for our study year) and do not provide useful information on the forage lease market. However, Bureau of Indian Affairs (BIA) leases do appear to represent market leasing rates. According to BIA personnel, BIA leases are determined by competitive bid and negotiation. In our sample of 32 BIA leases the average lease was at $8.37 and the range was from $5.85 to $14.00. These leases are similar to state leases in that they typically have few landlord services. In May 1992, the BIA issued an appraisal for leases on the Fort Peck Reservation. The appraiser, Anita Bauer, reported that through a phone survey she identified 17 useable private leases both on and off the Fort Peck Reservation. The average market price where landlord provided all the livestock care was $11.00/AUM and where the tenant provided all the care the average price was $8.35/AUM. This is consistent with the findings for northeastern Montana of our survey undertaken for state lands. Anita Bauer concluded that a rate of $8.00 was a fair market value for BIA range units in the Fort Peck area. BIA's policy is that tribal members have discounted minimum bid rates- in this case $7.00.

A final perspective on a fair market AUM-based price is provided by our literature review. Ghosh and Fowler (1988) did a study of the value of public grazing leases in New Mexico. The study found that about 30% of the private market lease rate was for services. Accordingly, They suggest that the value of forage on public leases (at least for New Mexico) is given by taking 70% of the private market lease rate for nonirrigated lands. Assuming that this ratio holds for Montana, and applying it to our dryland private reference price in Table 5-1 (at $11.27/AUM) yields an estimate of the value of state grazing leases in Montana at $7.89.

All of the six methods tend to lead to a fair market value for state grazing leases that is around 70% of the private dryland lease rate (last column of Table 5-1). The only approach that is much higher is the rancher "reported" fair price for the group of all ranchers at $9.01. All the other estimates are bracketed by the fairly narrow range of $7.62 to $8.37.

Currently the state uses a minimum bid price of $4.17. This is really a default price in that there is very little competitive bidding for state grazing leases. Should the state choose to set a default price at something closer to fair market value, say $7.50 or $8.00, one way to do this would be to simply change the "pound factor" in the beef price formula from "six" to another base. For example, a price of $7.50 (when beef is $0.695 per pound) is given by using the factor 10.8.

It may be noted that this specific "pound factor" (of 10.8) has the interpretation of being 21% of the supposed 50 pound weight gain per AUM. (The current price of $4.17 is based on a percentage of 12%, as discussed earlier.) Interestingly, this is quite close to the factor used by South Dakota in its beef price formula. South Dakota uses 20% and has a current AUM price of $7.08. Oklahoma also used to employ a beef price formula. For example, the AUM price in Oklahoma in 1980 was $7.41/AUM based on a 25% share to the state land office, the weight of an average yearling calf (425 pounds in a year or 35.4 pounds in a month) and the price of calves ($0.837/lb in 1980).

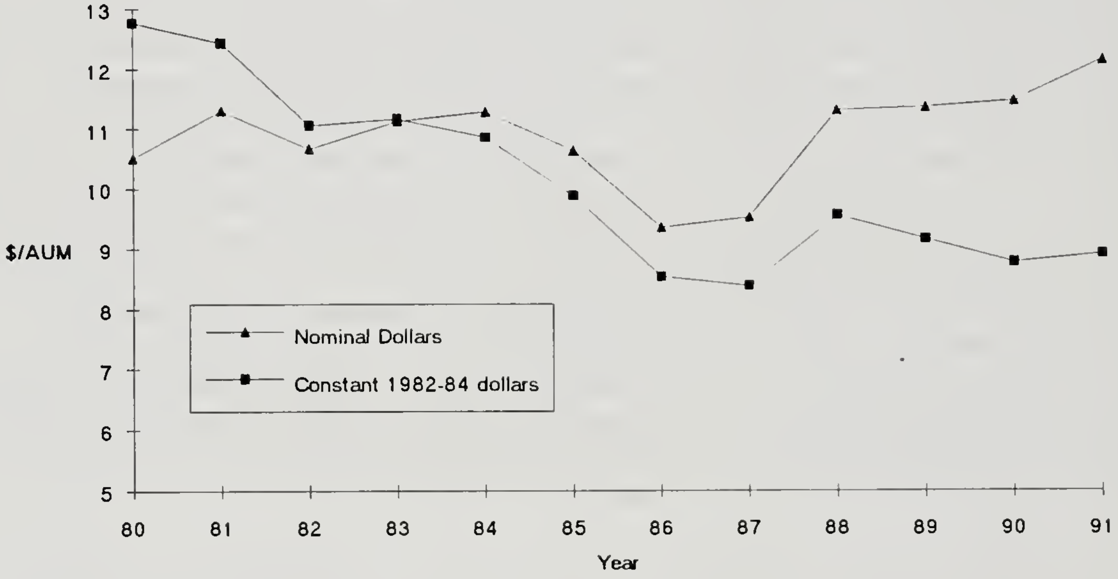
A related question is whether the beef price is a good way to keep the AUM price up to date. Our analysis shows that over the long term it is; our model relating AUM price to beef price for western states showed a very high correlation (adjusted R-square of .85). However, this result may be dominated by the long term effect of overall price inflation in the economy (making both beef prices and forage rental rates move together over time). The relationship of beef price and the AUM market rate in the shorter term (the last ten years) shows a much weaker relationship. These somewhat mixed results suggest that if Montana is only going to study its grazing fees at lengthy intervals, the beef price index approach is reasonable in the long term. However, greater realism would result from a formula that ties the state lease rate to actual market lease rates for forage, rather than the beef price. These lease rates are already available on an annual basis from the July cattle survey. As discussed above, this survey of "reported average in your area" seems to provide a good approximation to actual market leases. We would strongly recommend tying the state grazing lease rate to the private market lease rate. One approach would be to just make the state lease rate equal to 70% of the most recent reported private market grazing lease rate. The state could adopt a policy of adjusting lease rates annually as soon as the new July cattle survey results are available. There is usually a very quick turnaround in the availability of these results from the Agricultural Statistics Service. The state could also cooperate with Montana Agricultural Statistics to have private market grazing lease rates reported on a district level (e.g. northeast Montana, central Montana, etc.). This may be justified given our findings of significant differences in private lease rates in different areas of the state.

Note that in Table 5-1 the estimated fair market prices for state grazing leases are compared to our survey-based estimate of private dryland grazing leases in Montana of $11.27 for 1992. Typically the ratio of out various estimates to the $11.27 value are around 70%. However, if state lease rates are to be tied to the "reported" typical prices based on the July cattle survey, the latter (at around $12.00/AUM) appear to be somewhat higher than the estimate based on an actual sample of contract leases. If a point estimate for the fair market value on state leases is about $8.00 and the July cattle survey estimates are around $12.00, this suggests setting state leases not at 70% of the July Agricultural Statistics Service estimate, but rather at two thirds (66.7%).

We note that several of our reviewers expressed concern that private market lease rates in 1992 may have been high compared to the historical average due to drought conditions. This could be a legitimate concern if we were suggesting that our estimate of fair market price for forage for 1992 be used for a number of years. This is not our recommendation. State lease rates should be tied to market rates and adjusted annually. By tying state lease rates to actual private grazing lease rates on an annual basis, one automatically corrects for all market effects. For example, if drought has increased the market price for 1992 and there is no drought in 1993, then (other things equal) market prices for forage will go down in 1993 and this change would be reflected in state lease rates that are tied to the market price.

It is interesting to note that there has been considerable movement in private market grazing lease rate over time (Figure 5-1). In recent years prices did increase substantially from 1987 to 1988 (both in nominal and constant dollar terms). This may in part be due to drought conditions in 1988. Between 1988 and 1991 private market grazing lease rates declined to 1990 and then increased just slightly in 1991.

Figure 5-1. Private Montana AUM lease rates from 1980-1981.



An alternative basis for charging on state grazing leases is to use a dollar per acre rather than a dollar per AUM approach. In fact the way Montana state leases are administered is in some ways more akin to a dollar per acre or lump sum lease basis. State lands have no provision for "non-use" such as the Forest Service or BLM grazing leases and permits. This means that the tenant must pay for a state lease regardless of whether or not there is forage for his or her livestock. The state establishes carrying capacity for a given lease that is estimated at ten year intervals. Contract rent is based on the AUM capacity times the dollar/AUM formula value. Since stocking rates are not monitored by the state, in practice the state's dollar/AUM contracts are more like a fixed sum or dollar per acre contract. In the private market, AUM based contract total payments are usually adjusted to reflect the actual AUM's used. In this way, there is some risk sharing if forage is limited due to drought or other factors.

Several of our reviewers commented on the fact that state leases have no "non-use" provisions such as for Forest Service or BLM leases, and suggested that this might reduce the value of the lease. The other side of this coin is that the state also does not have any "over-use" provisions. Unlike the Forest Service, the state does not count stock off the lease to verify that the contract stocking rate is not exceeded. We would recommend that actual stocking rates on state leases be given further study.

Given the way state leases are actually administered is more like a cash rent basis, it is of interest to examine the private market for dollar/acre leases. The private market dollar/acre leases that are most like state leases (term greater than 5 years, dryland and no fence maintenance services) average $1.77 per acre (sample of only eight leases. Based on our comparison of productivity and forage quality, state leases are similar to this subsample of private leases. Similarly leases on a dollar/ranch basis average $2.26 per acre for the subsample of private market leases most like state leases (sample of eight leases). By comparison to the current average value the state receives per acre ($1.01), these findings suggest that fair market state lease rates on a per acre basis could be around $2.00 or double the current level. These findings are similar to the AUM-based discussion summarized in Table 5-1.

Another concern of our reviewers was that state leases are more likely to be inholdings than private leases. Our hedonic model showed that several factors (both whether the lease was an inholding totally surrounded by private ground and also whether noxious weeds were a problem on the lease) had a small negative effect on private lease market rates- on the order of $0.40/AUM. However, these estimated marginal prices were not statistically different from zero. A larger sample might show these factors to be statistically significant. Even if these effects on price due to inholdings and noxious weeds were valid, they would apply to only a fraction of state lands that are inholdings (36 percent) and have noxious weed problems (22 percent). This would indicate a price adjustment for these leases of around 15 cents for inholdings and 10 cents for noxious weeds.

The inholding issue is troublesome because these units are typically unfenced. This means that the only logical user of these units is the rancher who owns the surrounding land. This means there is unlikely to be competition for the lease, but it also means the rancher has little choice but to use the unit and pay the state-determined rate. As long as the state rates are fairly determined, this shouldn't pose a problem. Recall that the usual definition of a fair market price is the price that a willing buyer and a willing seller will agree to. In the long run, it would be better if the state could sell or exchange inholdings and block up more economic range units. This could be accomplished through a "land bank" policy such as is used in other states and discussed in our Task 2 report. This would lead to more competition for state leases and higher returns to the trust.

The problem of preference rights and competitive bidding is difficult to analyze but potentially very significant for state trust land revenues. As discussed in Section 4.8, there are a number of reasons that there is only limited competitive bidding on state grazing leases. Experience in other states suggests that eliminating preference rights would increase competitive bidding and thereby state revenues. The issue of preference rights is an emotional one; our survey does not provide much information for predicting what this change would do for Montana. We would suggest a more systematic and detailed examination of the experience in other states.

Nebraska and Oklahoma stand out as the two states that have most successfully used competitive bidding and the elimination of preference rights to increase returns on state grazing leases (see the discussion in Section 1.2 and Table 1.2 and Figure 1.1). Both of these states experienced lawsuits in which claimants charged that fair market value was not being realized on state grazing leases. The suit in Oklahoma, in the early 1980's, resulted in a doubling of lease rates and a change to oral auctions on all leases. Minimum lease rates in Oklahoma are set for each lease by appraisal at market value. The range of these lease rates is currently from 75% to 135% of the average private market lease rate (Table 1.2). Procedures are similar in Nebraska, with lease rates ranging from 60% to 100% of the average private market lease rate. These states have only a very few leases that are vacant. By comparison, Montana's current minimum (and average) state land grazing lease rate is about 35% of the average private grazing lease rate for this state.

Even in Oklahoma and Nebraska there are a number of leases for which there are no competing bids. The relatively high lease rates achieved in those states appear to be due more to the establishment of minimum bids reflecting market appraised values for each lease prior to auction. Unlike Montana, where DSL field staff is largely involved in estimating carrying capacities, the field staff in Oklahoma and Nebraska are heavily involved in appraisal activity. These states also favor five year terms and leases rentals are updated annually based on market conditions. The field staffs in these states are about the same size as in Montana, but take care of only a third to a fifth as many acres and numbers of leases. In order to switch to a system like Oklahoma and Nebraska, Montana would probably need to increase field staff and retrain from carrying capacity evaluation to appraisal.

A final generic policy issue is whether revenues would be significantly influenced by "packaging" control over multiple uses in a single lease. There has not been much work done on this issue, but practices vary considerably across states. For example, in some states control of surface agricultural uses is leased along with control over recreational access (e.g. Oklahoma). Minimum bids for any given lease in Oklahoma are based on the highest and best use. If a lease returns more in a recreational use than grazing (for example), it is reclassified for the highest and best use. In principle Montana could also "bundle" control of recreational access with another surface use (such as grazing) and charge higher fees to provide a return to recreational use. Under such a system, competitive bidding could also (in principle) capture the value of complementary recreational use. Tenants would need to have the right to charge for access or sublease recreation rights to outfitters. All of this is possible in principle given the applications in other states; however, one would need to investigate the existence of legal or statutory barriers to such a policy.

The question of whether to combine recreational access and other surface use rights in a single lease is in part an empirical issue. One would want to know if the school trust could earn a greater return by this policy or the existing policy toward recreational use. As noted in section 4.9, some ranchers indicate they are willing to pay a higher AUM lease rate to have the right to control access. The analysis indicates that about 25% of ranchers would be willing to pay an extra $2/AUM to control access; this is an average over the sample of about $0.50 per AUM or a total of about $500,000 over all grazing lease contracts. This is considerably more than the approximately $150,000 revenue from the DSL Recreation Use permit sales for 1992 (as of October 31) plus the approximately $55,000 obtained with outfitter leases. However, these programs are quite new, are probably not priced at fair market value and may show increased sales in the future. Additionally, one would have to design a system for obtaining extra payment from ranchers who wanted to control access. It would appear that combining recreational access and other surface use rights in a single lease could be done most effectively when leases are on a lump sum or dollar per acre basis and when there is good participation in competitive bidding. Neither of these conditions presently hold in Montana. It is an open empirical question as to whether combining recreational access rights with surface uses in Montana would generate a better return to the school trust than current policy.

5.4 Conclusions

As a result of an intensive (and extensive) survey of Montana ranchers concerning grazing lease rates and four additional methods of analysis, we conclude that current state lease rates are much lower than current fair market value. Lease rates on Montana DSL grazing leases currently average $4.24 per AUM. The preceding analysis suggests that fair market value for these leases is on the order $7.50 to $8.50 per AUM.

Table 5-1. Summary of alternative estimates of fair market value for Montana state lands grazing leases (1992 dollar/AUM basis).

Estimate	Mean $/AUM	95% Confid. Interval	Standard Error	Sample Size	Percent of private dryland
A. Private market reference prices.					
All private leases	11.41	11.06 - 11.76	0.180	243	101
Dryland private	11.27	10.89 - 11.65	0.196	207	100
B. Estimates of fair market value for Montana state grazing leases.					
1. Hedonic model "typical state lease" (no services, term > 5 years)	7.69	6.23 - 9.14	0.740	139	67
2. Subsample of private leases: >5 year, no fence maintenance services, dryland.	7.90	5.85 - 9.95	1.045	6	69
3. Competitive bids for state grazing leases.	8.34			613	73
4. Rancher "reported" fair price for state lease					
- all ranchers	9.01	8.68 - 9.34	0.170	601	79
- state lease holders	7.62	6.93 - 8.31	0.350	137	67
5. BIA Montana Leases	8.37	7.63 - 9.11	0.380	32	74
6. Literature review: (Torell, Ghosh, and Fowler, 1988) ratio of public lease forage value to private					
- New Mexico estimate					70
- Applied to Montana	7.89	7.62 - 8.16	0.137	207	70

Note: Standard error for estimate 5. assumes the ratio .70 is a known constant.

REFERENCES

Bartlett, E.T., John R. McKean and Wendell Winger. 1983. Grazing Lease and Fee Arrangements of Western Governments and Agencies for Study of Western State, Local Governments, and Other Federal Agencies Grazing Leasing Arrangements and User Charges. Report for USDA Forest Service. Colorado State University.

Borman, Michael E. and Douglas E. Johnson. 1990. "Evolution of Grazing and Land Tenure Policies on Public Lands", Rangelands 12(4):203-206.

Cameron, T. A. 1988. "A New Paradigm for Valuing Non-Market Goods Using Referendum Data: Maximum Likelihood Estimation by Censored Logistic Regression", J. Environ. Econ. Manage. (15):355-379.

Duffield, J. and D. Patterson. 1991. "Infrence and Optimal Design for a Welfare Measure in Dichotomous Choice Contingent Valuation", Land Economics 67(2):225-239.

Hanemann, W. M. 1989. "Welfare Evaluations in Contingent Valuation Experiments with Discrete Responses: Reply", Am. J. Agric. Econ. (66):332-341.

McCarl, Bruce A. and Ray F. Broken. 1985. "An Economic Analysis of Alternative Grazing Fee Systems", American Journal of Agricultural Economics 769-778.

Ridker, R.G. and J.A. Henning. 1962. "The Determination of Residential Property Values with Special Reference to Air Pollution", Rev. of Econ. & Statistics (49):246-57.

Rosen, J. 1974. "Hedonis Prices and Implicit Markets: Product Differentiation in Pure Competition", J. of Polit. Econ. (82):34-55.

Rouse, L. Roy. 1991. Final Report, Rangeland Survey for the State Land Board (Colorado).

Souder, Jon A. Economic Strategies for the Management of School and Institutional Trust Lands: A Comparative Study of Ten Western States. 1990. Ph.D. Dissertation, University of California at Berkeley.

Souder, Jon A. and Sally K. Fairfax. 1990. "The State School Trust Lands". Paper presented at the 1990 Annual Meeting of the Western Political Science Association, Newport Beach, CA.

REFERENCES (Cont'd)

Souder, Jon A. and Sally K. Fairfax. 1991. Western States Trust and Sovereign Lands Survey Results. Project #4548-H, Agricultural Experiment Station, University of California at Berkeley.

Tittman, Paul B. and Clifton E. Brownell. 1984. Appraisal Report Estimating Fair Market Rental Value of Public Rangelands in the Western United States. U.S. Forest Service and Bureau of Land Management (Volume I and II).

Torell, L. Allen and John P. Doll. 1991. "Public Land Policy and the Value of Grazing Permits", Western Journal of Agricultural Economics 16(1):174-184.

Torell, L. Allen and John M. Fowler. 1988. Economic Considerations for Settling Grazing Fees on New Mexico State Trust Lands. New Mexico State University Agr. Exp. Sta. Special Rep. 81.

U.S. Department of Agriculture and U.S. Department of Interior. 1986. Grazing Fee Review and Evaluation.

U.S. Department of Agriculture and U.S. Department of Interior. 1992. Grazing Fee Review and Evaluation, Update of the 1986 Final Report.

Ward K.M. and and J. Duffield. 1992. "Natural Resource Damages: Law and Economics", John Wiley and Sons.

Workman, John P. 1988. "Federal Grazing Fees: A Controversy that Won't Go Away", Rangelands 10(3): 128-131.

APPENDIX A. Memorandum of Understanding: Montana Deptartment of State Lands and Montana Agricultural Statistics Service. (August 26, 1992)

RECEIVED
AUG 27 1992
STATE LANDS

MEMORANDUM OF UNDERSTANDING

This Memorandum of Understanding is entered into on the date last written below between the Montana Department of State Lands (hereafter referred to as "State Lands") and the Montana Agricultural Statistics Service (hereafter referred to as "Service").

WHEREAS, State Lands is charged with the duty of administering the State of Montana trust lands and obtaining full market value for the disposition of interest in those lands,

WHEREAS, the 1991 Montana Legislature directed State Lands to conduct a study to determine the value of surface uses of state trust lands,

WHEREAS, State Lands has determined that the best means of conducting the economic study is to obtain reliable information from Montana farmers and ranchers by means of polling them,

WHEREAS, the Service has an expertise in polling and has accurate and current names and addresses of farmers and ranchers in Montana,

WHEREAS, the parties determined that it is desirable for the parties to enter into a Memorandum of Understanding to memorialize the procedure whereby the Service will conduct information gathering for State Lands' economic study.

NOW THEREFORE, the parties hereby agree as follows:

1. The Service shall provide State Lands with estimated costs and response rates for implementing a survey of agricultural operators as in paragraph 4. The approach to be used is a phone survey using standard telephone procedures. State Lands will provide a copy of the survey instrument, with the survey to be implemented within the time period September 15 to October 15, 1992. The Service shall provide an estimate of cost of implementing the survey using a telephone procedure. The estimate will include the cost of 1) basic setup for a CATI implemented procedure and 2) per hour costs for interviewers (this cost will include overhead and phone charges). The Service will provide a sample questionnaire and related costs and response broken down by hours for a typical agricultural survey (probably the September agricultural survey).

2. State Lands shall provide the Service with a copy of draft survey instruments and a survey plan. After amendment of this memorandum pursuant to paragraph 8, the Service shall review the instruments and plan and comment upon and make recommended changes

to the instruments and plan using the Service's expertise in the area of survey design.

3. After amendment of this Memorandum pursuant to paragraph 8, the parties shall determine the specific criteria for drawing names for each sample cooperatively. The Service shall provide frequency distributions or other descriptive statistics for the sample frame to inform the choice of sample stratifications. The Service will use the same breakpoints in these frequency distributions as are used in the census of agriculture. A possible breakpoint for the survey would be at 49 acres for cropland, and possibly no stratification for the cattle and sheep list.

4. After amendment of this Memorandum pursuant to paragraph 8, the Service shall survey two samples of Montana agricultural operators. One sample will be 1,000 names on the Service's cropland list. The purpose of this drawing is to investigate the current market terms for the lease of privately owned cropland in Montana. The second sample will be 1,000 names of the cattle and sheep raisers in Montana. The purpose of drawing this sample is to investigate the current market rates and terms for lease of privately owned grazing land in Montana. The method of survey will be by telephone. The sample will be drawn systematically from a ranked array by size of operators for each sample frame. This will be done without replacement to eliminate the problem of individuals being drawn on both lists. At State Lands' request, the Service may implement a pre-test of a size to be determined (probably 100 names) based at the costs specified in paragraph 1.

5. State Lands will provide to the Service an estimate of the total hours of survey time based on the Services sample questionnaire costs and response rates, interpolated for the length of the questionnaires to be implemented. This estimate will be provided within the time frame of August 15 to August 25, 1992.

6. In conducting the surveys pursuant to this agreement, the Service shall use its established procedures for surveying, including preservation of the confidentiality of the respondents. These established procedures include respondents being offered an opportunity to receive a summary of the results of the survey. State Lands will provide the Service with an adequate number of mailable (including postage) copies for this purpose.

7. In any formal publication of the results, the cooperation of the Service will be acknowledged.

8. The Service is not required to perform the duties required in accordance with paragraphs 2, 3 and 4 until such time as this Memorandum is amended to provide payment for those services. The payment will be made by State Lands contractor, Bioeconomics, Inc., and will be in the form of expected total costs up front to be held by the Service until the survey is completed. A check must accompany the completed (amended) Memorandum which should be in place by September 1. If the costs are overestimated, they shall be refunded to Bioeconomics, Inc. If the costs are underestimated,

the parties shall negotiate to establish a reasonable cost figure.

9. This Memorandum may be amended in writing by the parties.

10. This Memorandum is effective on the date last below written and expires on February 1, 1993.

MONTANA AGRICULTURAL STATISTICS

By: James K. Sands 8·26·92
State Statistician
Date

MONTANA DEPARTMENT OF STATE LANDS

By: 8-20-92
Dennis D. Casey, Commissioner
Date

APPENDIX B. Pilot Grazing Phone Survey Instrument, Rangehands, Inc. (June 1992)

Rangehands, Inc.
Grazing Lease Questionaire

(Basic Respondent Information, Part 1)

Respondent:______________________________________ Phone______________

Address:____

____

1. Do you lease grazing from anyone? _______YES ______NO

2. _________ Private

   _________ State

   _________ BLM

   _________ Forest Service

   _________ Other

3. Type of ranching operation: _________ Cow/calf

   _________ Yearling

   _________ Sheep/lamb

   _________ Other

4. Size of operation:

Cattle	Sheep	
________	________	less than 100 head
________	________	100 to 500 head
________	________	500 to 1000 head
________	________	over 1000 head

** Go to "Basic Lease Information Sheet" **

Basic Lease Information (complete one sheet per lease type)

Type of Lease:
______ Private
______ State (check only one per sheet)
______ BLM
______ Forest Service
______ Other

Verbal Contract ______ Written Contract ________

Forage Lease _______ Land Lease _________ (check correct responses)

Dryland ___________ Irrigated __________

Basis for rental:		Rate
______	AUM	________________
______	ACRE	________________
______	RANCH	________________

Term of lease: ________________

Services Included:

	Yes	No	Comments
Fence construction	___	___	______________
Fence maintenance	___	___	______________
Herd management (salting, health care, check water, etc)	___	___	______________
Improvements (water development, cattle guards, buildings, corrals)	___	___	______________
Unconditional use (stocking rates, timing of grazing, etc.)	___	___	______________
Do you control public access?	___	___	______________
Other provisions (list)	___	___	______________
______________________	___	___	______________

** After all "Basic Lease Information" sheets are completed, **
go to "Basic Respondent Information, Part 2"

(Basic respondent information, Part 2)

5. How do you define an AUM (animal unit month)?

______ Cow only

______ Cow with calf

______ Other (explain) ____

6. What are the going rates for grazing leases in your area?

AUM ______________ ACRE ______________ RANCH ______________

7. What criteria do you use to determine the desirability of a lease and what you are willing to pay for it? **

_____ location/proximity

_____ productivity

_____ price

_____ need

_____ control (level of)

_____ term of lease (renewability)

_____ forage quality

_____ water supply

_____ other (list)

_____ ________________________

_____ ________________________

_____ ________________________

** List top three in order of importance

(Basic Respondent Information, Part 2 cont.)

8. What are positives and negatives of lease types?

	Positive			Negative		
	Private	State	Federal	Private	State	Federal
Price						
Stability/ Reliability						
Flexibility/ Negotiability						
Restrictions on use/control						
Length of lease						
Public access						
Market influences on price						
Amount of services provided						
Land quality						
Bureaucracy						
Lessor quality						
Livestock safety						
Location/Availab.						
Water supply						

APPENDIX C. Final Report, Grazing Lease Pre-Survey, Rangehands, Inc. (September 2, 1992)

RANGEHANDS

BRIAN SINDELAR, Ph. D

23833 Dry Creek Road
Belgrade, MT 59714
(406) 388–4625 or
(406) 587–3842

JOHN HANSEN, MS

John W. Duffield
Bioeconomics, Inc.
3699 Larch Camp Rd.
Missoula, MT 59803

September 2, 1992

Dear John:

Enclosed is the brief report you requested regarding the results of our pre-survey of grazing leases in Montana.

We enjoyed and appreciated the opportunity to work with you. If we may be of additional help with the survey, don't hesitate to contact us. We expect that the survey will go well and look forward to the learning of the results of the big one!

Thanks for including us in your study team.

Sincerely,

Brian

Brian Sindelar

encl

Final Report

Grazing Lease Pre-Survey

Prepared by Rangehands, Inc.
23833 Dry Creek Rd.
Belgrade, MT 59714

Introduction

The purpose of this report is to identify and characterize the responses of a sample of Montana ranchers to a preliminary questionnaire regarding grazing leases on private and public lands in Montana. The survey was conducted during the period July 1 - August 17, 1992. The State was sub-divided into six regions and respondents were identified and contacted in each region. Forty livestock producers were contacted and 38 interviews were conducted.

The questionnaire was designed to learn about factors which affect the values of grazing leases in Montana. It provided information which was used in development of a comprehensive survey instrument to be administered by Montana Agricultural Statistical Services as directed by Bioeconomics Inc. The preliminary survey instrument was revised a number of times throughout the survey with the assistance of the respondents. Among issues addressed by the survey were criteria used by ranchers to determine the desirability of leases and rancher perceptions of state, federal, and private grazing leases. The survey also provided basic information about numbers of grazing leases, livestock numbers, leases rates, and services provided in leases.

Summary of Results

The following observations and measures were compiled:

1. Forty ranchers were contacted, of which 2 declined to be interviewed. Thirty-three respondents held grazing leases and 1 landowner leased grazing.

2. Regional distribution of respondents in Montana:

Northwest	6	Southwest	8
Northcentral	11	Southcentral	2
Northeast	7	Southeast	4

3. Distribution of lease types:

Private	28	(40%)
State	19	(27%)
BLM	17	(24%)
USFS	3	(4%)
Other*	3	(4%)
Total	- 70	

* Bureau of Reclamation, Bureau of Indian Affairs, and CM Russell Game Range.

4. Types of operation included:

Cow/calf	30	operations	(91%)
Yearling	10	"	(30%)
Ewe/lamb	3	"	(9%)
Other (dairy)	1	"	(3%)

5. Size of operations based on number of animals

Head	Cattle	Sheep (number of operations)
<100	3	1
100-499	20	0
500-999	5	0
>1000	5	2
Total	33	3

6. All respondents considered an AUM to be a cow with calf.

7. The going rates for an AUM on private land in the respondents' region of operation based on hearsay were:

Range - $6-$20/AUM

Most frequent - $12-$16/AUM

There was the appearance of regional differences but sample size precluded elaboration.

8. Criteria determining lease desirability believed most important by the respondents were given index values based on respondent rating of the 3 most important criteria. The criteria in order of importance were:

	Index Value
Location/compatibility with operation	45
Water quality/quantity/location	31
Production/quality/reliability of forage	29
Price of lease	11
Length of lease term	9
Control of public access	6
Need	6
Fences (quality)	4
Working facilities	4
Security of animals	2

9. Respondents' feelings about private, state, and federal leases were expressed in positive and negative statements about 20 criteria. The most frequent encountered comments are summarized as follows:

Factors	Private	State/Federal	Number of Comments
1. Restrictions on use	+	-	25
2. Price	-	+	22
3. Public access	+	-	18
4. Stability/reliability (lease renewal)	-	+	15
5. Flexibility/ negotiability	+	-	13
6. Land quality	+	-	13
7. Length of lease	-	+	12

10. Prices of private leases were highly variable, with the lease bases including AUMs, acres, and ranch-size units. The trend in pricing was that leases providing most services received highest prices. The leases ranged on an AUM basis from $7.00 to $16.00. On a per acre basis, prices ranged from $1.00 (dryland) to $24.00 (irrigated). Land productivity appeared to be of major importance in per acre leases. Regional and service differences were also important. Ranch leases tended to be complex and form of payment varied from animal shares, to flat fees, to taxes plus 10%. Lease prices sometimes reflected animal performance and market prices.

11. General observations:

Services associated with leases were critical factors driving lease prices on private land. Respondents invariably noted that minimal services provided in federal and state leases justified low lease prices.

Land quality was generally believed to be lower on BLM administered lands and was frequently cited as a basis for low lease prices.

Irregular size and distribution of State lands, especially "inholdings" was a concern for respondents holding state leases. They felt an obligation to lease inholdings to protect the integrity of their operations.

Inholdings of all government lands were a complicating factor in determination of responsibility for management, improvements, and identifying bases for prices paid.

While public access to government lands was not found to be critical in affecting lease desirability, it was frequently cited as a negative factor. There was a definite regional bias regarding public access. Less concern was expressed by respondents in sparsely populated regions.

Competitive bidding for State grazing leases was a concern for some respondents. They believed that the State needed to adopt methods to ensure fairness in the bidding process. Poor communication between State and those affected by bidding was identified by several respondents.

APPENDIX D. Mailing to Grazing Survey Sample from Montana Agricultural Statistics (September 22, 1992).

MONTANA AGRICULTURAL STATISTICS SERVICE

U.S. DEPARTMENT OF AGRICULTURE COOPERATING WITH MONTANA DEPARTMENT OF AGRICULTURE

P.O. BOX 4369 -- HELENA, MONTANA 59604

(406) 449-5303

September 22, 1992

Dear Montana rancher:

The Montana Agricultural Statistics Service has been asked to conduct a survey concerning grazing leases. This study is at the request of the Montana State Legislature and is in cooperation with the Montana Department of State Lands.

Your name was randomly drawn from our list of Montana cattle and sheep operators. The survey will be conducted by telephone. We are writing to let you know that we will phone you sometime in the next few weeks. We have found that survey participants appreciate this advance notice. It gives you an idea of the kind of questions we will be asking and provides you with an opportunity to research your records if necessary. This makes our survey more efficient--saving time both for you and our phone survey staff.

Following this introductory letter, we have listed many of the questions that you will be asked. You can look these over at your leisure. It may be that you can answer all of these questions off the top of your head. For some of the questions you may need to refer to your records. It may be helpful for you to keep this letter and any notes near your phone for your reference when we call for your interview. At that time, if we happen to catch you at an inconvenient moment, we will be happy to call you back at the time you specify.

Your name was randomly drawn to represent a particular size of ranch. In order for our survey to be representative, it is very important that we obtain information about your operation. As with all of our surveys, your responses are completely confidential and are never associated with your name. If you so desire, we will be glad to provide you with a copy of the survey results. We will ask you about this during the telephone interview. We hope to have results to mail out in January.

We look forward to talking with you. Thank you in advance for taking the time to help us on this survey. Should you have any questions for us please feel free to call Curt Lund or myself at 1-800-835-2612.

Sincerely,

James K. Sands

James K. Sands
State Statistician

INSTRUCTIONS FOR SURVEY PARTICIPANTS: The following questions represent most of the questions you will be asked in your telephone interview. Every respondent will be asked the questions in Section A and Section E. If you are a tenant or landlord on a grazing lease, you will be asked the questions in Section D for up to four of your largest leases (2 largest private leases, and largest state lease, and largest other public lease, or, if no state lease, your 2 largest other public leases).

SECTION A - ACRES OPERATED

1. The total acres operated under this land arrangement, include farmstead, all cropland, woodland, pasture land, wasteland, and government program land.

1a. On July 1, how many acres did this operation **own**? .... Acres ☐

1b. How many acres did this operation **Rent from others?** (Exclude land used on an animal unit month (AUM) basis) .... Acres ☐

1c. How many acres are used on a fee per head or animal unit month (AUM) basis, rented either from a public agency or a private party? .... Acres ☐

1d. Rent to others .... Acres ☐

1e. Then the total acres operated under this arrangement are (1a + 1b + 1c-1d) Total Acres ☐

SECTION B - GENERAL QUESTIONS FOR TENANTS

1. What was the size of your livestock operation on July 1 of this year?

	Number
Cow/calf pairs	
Yearlings	
Sheep	
Other:	

2. How many grazing leases do you hold from:

	Number of Leases	Total Acres by Category
a. Private		
b. State		
c. BLM		
d. Forest Service		
e. BIA		
f. Other Public Agency: (specify)		
g. Grazing District or Grazing Association Membership		

SECTION C - GENERAL QUESTIONS FOR LANDLORDS

1. You previously listed (item 1d)__________ acres of your operation as being rented out to other operators. How many of these acres are leased from you for grazing? .... Acres ☐

2. How many separate such grazing leases have you let? .... Number of Leases ☐

SECTION D - INFORMATION ON EACH LEASE - LANDLORD OR TENANT

Now I'd like to ask you some questions specific to the grazing lease(s) you hold either as a tenant or landlord. IF MORE THA ONE, let's start with the largest private lease.

1. How many acres is this lease for: .... Acres ☐

2. Is this lease an inholding in the sense that it is totally surrounded by private ground?

☐ YES ☐ NO (IF YES): Is this inholding fenced separately? ☐ YES ☐ NO

3. As of July 1, what type of livestock is run on this lease, how many pairs or head?

√	LIVESTOCK TYPE	Number Pairs or head
	Cow/calf pairs	
	Yearlings	
	Sheep	
	Other (specify):	
	Can't answer, lease is part of a larger pasture plan	

4. What is the basis for the rental on this particular lease and what is the rental rate?

√	Basis for Rent	Enter Rate
	AUM or cow/calf pair	
	Per head, stock type:	
	Acre	
	Ranch	
	Other (specify):	

5. What is the length in years of the rental agreement on this lease? .... Term in Years ☐

6. How many years has this lease been held by the tenant's operation? .... Years held ☐

7. For this lease, I'd like to know what services the landowner provides. I will read you a list of specific services and you can tell me if the landowner provides nothing, materials only, materials and some labor, or if the landowner covers all costs:

Landlord Provides:	Nothing	Materials Only	Materials, Some Labor	All Costs
a. Fence construction				
b. Fence maintenance				
c. Water development				
d. Buildings & corrals				
e. Herd management: move livestock, salting, health care, checking water, etc.				
f. Weed control				

8. Is there a noxious weed problem on this lease? ☐ YES ☐ NO

If Yes, what was the actual cost to you over the last twelve months of weed control on this lease including your labor and equipment time? .... Dollars ☐

9. For the type of livestock run on this lease, what is the average per head ending sale weight for the ranch?

	Average Weight
Calves	
Cattle	
Lambs	
Other (specify):	

Is this average sale weight for the ranch indicative of production on this lease as well? ☐ YES ☐ NO

10. Can you estimate what average weight livestock go on this lease at, and what their average weight is wher they come off the leased ground?

Type of Livestock	Average weight when turned on lease	Average weight when come off lease
Calves		
Yearlings		
Lambs		
Other (specify):		

11. Is there a lease provision for the survivability of livestock on this lease? For example, does the lease agreement ensure that the tenant will receive some given percentage of the livestock turned out or some compensation for losses? ☐ YES ☐ NO

If yes, what are the terms of this survivability lease provision? (please check)

	Guaranteed percentage come off lease
	Dollar or other compensation for loss

Any Comment:____

12. In your experience with this lease, what percentage of the livestock you turn out on this lease will come off

Type of Livestock	Percent of Survival
Calves	
Cows	
Yearlings	
Lambs	
Ewes	

13. What has been the average conception rate for livestock that have been on this lease?

Percentage conception rate for all COWS turned out	
Percentage conception rate for all EWES turned out	

NOTE TO RESPONDENTS: If you have more than one lease either tenant or landlord status, this section may be repeated fo your next largest private lease and up to two of your largest state or federal leases.

SECTION E - GENERAL QUESTIONS ON LEASING (for all respondents)

1. Which of the following is the most commonly used method of charging for grazing on privately owned non irrigated grazing land in your area? What is the average charge for this method in your area?

√	Most common method of charging	Average charge for this method
	AUM or cow/calf pair	
	Per head, stock type:	
	Acre	
	Ranch	
	Other:	

Thanks very much for taking the time to look over our questions. At the time of your phone interview, we will ask you if yo have any other comments you would care to make on the issue of leasing grazing rights in Montana.

APPENDIX E. Final Draft Phone Script, Grazing Survey (August 26, 1992).

SAMPLE QUESTIONNAIRE - GRAZING LEASES VERSION

INSTRUCTIONS: This paper questionnaire will help explain the large Blaise survey instrument. Only one copy o each type of lease arrangement is included. The Blaise instrument will select the proper number and type c' lea for your interview.

- No respondent WILL BE asked to complete more than 4 lease arrangements.
- The priority for selection is: two largest private leases used as a tenant; two largest public leases with t largest State selected first followed by largest Non-State, two largest landlord leases.
- For example: a respondent that has 4 private leases as a tenant and 2 State leases, would complete 2 private and 2 State leases. A respondent with 3 State leases and 2 BIA leases would complete 1 State and 1 BIA. A respondent with 4 State leases will fill out 2 State leases. A respondent with 1 private le as a tenant and is landlord of 3 leases would complete 1 private as a tenant and 2 as a landlord.

SECTION A - ACRES OPERATED

1. Please report for the total acres operated under this land arrangement, including the farmstead, all croplan woodland, pasture land, wasteland, and government program land.

1a. On July 1, how many acres did this operation own? . . . . Acres

1b. How many acres did this operation Rent from others? (Exclude land used on an animal unit month (AUM) basis) . . . . Acres

1c. Rent to others . . . . Acres

1d. How many acres are used on a fee per head or animal unit month (AUM) basis, rented either from a public agency or a private party? . . . . Acres

1e. Then the total acres operated under this arrangement are (1a + 1b-1c + 1d) Total Acres

2. Of the non-AUM land, how many acres would be considered cropland? (include land in hay and cropland in government programs.) . . . . Acres

3. Of the non-AUM land, how many acres of CRP are there? . . . . Acres

SECTION B - GENERAL QUESTIONS FOR TENANTS

1. What type of ranching operation primarily do you run and how many livestock, regardless of ownership, c you have on July 1 of this year?

Ranch Type (check only one)	Livestock Type	Number of pairs or head
	Cows/calf pairs	
	Yearlings	
	Sheep & lambs	
	Hogs & pigs	
	All Other Cattle	
	Other (specify):	

IF NO LIVESTOCK, GO TO SECTION D

2. On July 1, how many grazing leases of each type did you hold and how many acres were there?

Lease Category	Number of Leases	Total Acres in Lease Category
a. Private		
b. State		
c. BLM		
d. Forest Service		
e. BIA		
f. Grazing District or Grazing Association Membership		
g. Other Public Agency: (specify):		

IF NO LEASES, GO TO SECTION D

SECTION C - INFORMATION ON EACH LEASE - TENANT

Now I'd like to ask you some questions specific to the grazing lease(s) you hold as a tenant. IF MORE THAN ONE, let's start with the largest private lease.

1. How many acres is this lease for: . . . . Acres ☐

2. Is this lease an inholding in the sense that it is totally surrounded by private ground?
☐ YES ☐ NO IF YES: Is this inholding fenced separately? ☐ YES ☐ NO
IF NO, ask 2A and then 2B below.

2A. What is the distance in miles of this lease from your perimeter fence? . . . . Miles ☐

2B. Is there anything about the location or access to this lease that limits its marketability? ☐ YES ☐ NO
IF YES, What? Please comment____________________________________

3. As of July 1, what type of livestock is run on this lease and how many pairs or head?

√	LIVESTOCK TYPE	Number Pairs or head
	Cow/calf pairs	
	Yearlings	
	Sheep & lambs	

4. How many months are your livestock on this lease in a typical year? . . . . Months ☐

5. What is the major type of land this lease is on? ☐ Dryland ☐ Sub-irrigated ☐ Irrigated

6. What is the basis for the rental on this particular lease and what is the rental rate?

√	Basis for Rent	Rate
	AUM or cow/calf pair	
	Fee per head, yearlings	
	Fee per head, sheep	
	Acre	
	Ranch	
	Other (specify):	

7. What is the length in years of the rental agreement on this lease? . . . . Term in Years ☐

8. How many years has this lease been held by this operation? . . . . Years held ☐

9. Is this lease arrangement with a relative? ☐ YES ☐ NO

10. For this lease, I'd like to know what services the landowner provides. I will read you a list of specific services and you can tell me if the landowner provides nothing, materials only, labor only, materials and sc labor, or if the landowner covers all costs:

Landlord Provides:	Nothing	Materials Only	Labor Only	Materials, Some Labor	All Costs	Other: Specify Bel
a. Fence construction						
b. Fence maintenance						
c. Irrigation system(s)						
d. Buildings & machinery storage						
e. Grain storage						
f. Weed control						
g. Insect & disease control						
h. Fertilizer						

OTHER COST ARRANGEMENTS ____________________

____

11. Is there a noxious weed problem on this lease? ☐ YES ☐ NO

If Yes, what was the actual cost to you over the last twelve months of weed control on this lease including your labor and equipment? . . . . Total Dollars ☐

12. Do you essentially have the right to manage grazing on this lease as if it was your own land in terms of contolling stocking rates, on-off dates, and other aspects of the timing of the grazing use? ☐ YES ☐

Comments ____________________

13. For the type of livestock run on this lease, what is the average per head ending sale weight for the ranch

	Average Ranch Ending Sale Weight Lbs.	Is the average lease sale weight greater than, lighter than or equal to the average ranch weights?	Average On Weight Lbs.	Average Off Weight Lbs.	Is this a fairly accurate estimate a specific to producti on this Lease? Yes or No
Calves					
Yearlings					
Lambs					

14. Is there a lease provision for the survivability of livestock on this lease? For example, does the lease agreement ensure that you will receive some given percentage of the livestock turned out or some compensation for losses? ☐ YES ☐ NO

If YES, what are the terms of this survivability lease provision? (please check)

	Guaranteed percentage come off lease
	Dollar or other compensation for loss

Any comments concerning the terms of survivability? ____________________

____

15. In your experience with this lease, what percentage of the livestock you turn out on this lease will come of

Type of Livestock	Percent Survived
Calves	
Cows	
Yearlings	
Lambs	
Ewes	

16. What has been the average conception rate for livestock that have been turned out on this lease?

	Percent that conceive?	Is this a fairly accurate estimate and specific to this lease? Yes or No
Percentage conception rate for all COWS turned out		
Percentage conception rate for all EWES turned out		

17. How would you rate the productivity of this lease on a scale of: ☐ excellent, ☐ good, ☐ fair, or ☐ poor?

18. How would you rate the forage quality concerning this lease on a scale of: ☐ excellent, ☐ good, ☐ fair, or ☐ poor?

19. How would you rate the water quantity and location concerning this lease on a scale of: ☐ excellent, ☐ good, ☐ fair, ☐ poor or ☐ No water on lease?

20. With regard to water supply, how would you rate the water quality concerning this lease on a scale of: ☐ excellent, ☐ good, ☐ fair, or ☐ poor?

21. How would you rate the performance of this lease under drought conditions on a scale of: ☐ excellent, ☐ good, ☐ fair, or ☐ poor?

22. Do you control public access for fishing or hunting on this lease? ☐ YES ☐ NO

If Yes, do you allow access for hunting or fishing on this lease? ☐ YES ☐ NO

If Yes, do you :
- ☐ Allow people to hunt and fish for free
- ☐ Charge a fee: . . . . Dollars per day ☐
  (Add comment if not charged per day) ____________________
- ☐ Sublease to an outfitter . . . . Dollar Amount ☐
- ☐ Allow entry under block management
- ☐ Other (specify) ____________________

If No, does the landlord allow access for hunting or fishing on this lease? ☐ YES ☐ NO

If Yes, does landlord:
- ☐ Allow people to hunt and fish for free
- ☐ Charge a fee: . . . . Dollars per day ☐
  (Add comment if not charged per day) ____________________
- ☐ Sublease to an outfitter . . . . Dollar Amount ☐
- ☐ Allow entry under block management
- ☐ Other (specify) ____________________

ASK ONLY IF STATE LEASE:

23. To your knowledge, has there ever been a competing bid submitted to lease the agricultural lease on this parcel of land?

☐ YES

☐ NO, Can you speculate as to why no one else has bid in this lease? I will read you some possibl reasons and you can tell me which reasons apply:

☐ 1. Inholding status
☐ 2. Cost of Enclosure
☐ 3. Neighbor Relations
☐ 4. Other (specify) ____________

24. To your knowledge, has public or outfitted hunting or fishing use occurred on this lease in previous years prior to 1992?

☐ YES, What has generally been the recent status of public access on this lease?

☐ 1. Open Access
☐ 2. By Permission Only
☐ 3. Block Management
☐ 4. Generally Closed
☐ 5. Other (specify) ____________

☐ NO

25. Is this lease legally accessible by the public in the sense that there is an established public road or right-of-way or easement to the lease or it is accessible through adjacent public lands?

☐ YES, 25A. Would you be willing to pay additional dollars per AUM if you could control public recreational access on this lease? ☐ YES ☐ NO

25B. What is the main reason you would or would not be willing to pay this amount?

____

☐ NO ____________

NOTE: SECTION C MAY NEED TO BE COMPLETED FOR ADDITIONAL LEASES AS SPECIFIED IN THE INSTRUCTIONS.

SECTION D - GENERAL QUESTIONS FOR LANDLORDS

COMPLETE IF ACRES ARE REPORTED IN 1C OTHERWISE GO TO SECTION F

1. You previously listed (item 1c)________ acres of your operation as being rented out to other operators. How many of these acres are leased from you for grazing? . . . . Acres ☐

2. How many separate such grazing leases have you let? . . . . Number of leases ☐

SECTION E - INFORMATION ON EACH LEASE - LANDLORD

Now I'd like to ask you some questions specific to the grazing lease(s) you hold as a landlord. IF MORE THA ONE, let's start with the largest lease.

1. How many acres are in this lease? . . . . Acres ☐

2. Is this lease an inholding in the sense that it is totally surrounded by ground that the tenant operates?

☐ YES IF YES, is this inholding fenced separately? ☐ YES ☐ NO

☐ NO Ask 2A and then 2B below.

2A. What is the distance in miles of this lease from your tenant's perimeter fence? . Miles ☐

2B. Is there anything about the location or access to this lease that limits its marketability?

☐ YES What? Please comment____________
☐ NO

3. As of July 1, what type of livestock did your tenant run on this lease and how many pairs or head did he have?

✓	LIVESTOCK TYPE	Number Pairs or head
	Cow/calf pairs	
	Yearlings	
	Bulls	
	Sheep & lambs	

4. How many months are the tenant's livestock on this lease in a typical year? . . . . . Months ☐

5. What is the major type of land in this lease? ☐ Dryland ☐ Sub-irrigated ☐ Irrigated

6. What is the basis for the rental on this particular lease and what is the rental rate? Check one.

✓	Basis for Rent	Rate
	AUM or cow/calf pair	
	Fee per head, yearlings	
	Fee per head, sheep	
	Acre	
	Ranch	
	Other (specify):	

7. What is the length in years of the rental agreement on this lease? . . . . Term in Years ☐

8. How many years has this lease been held by the tenant's operation? . . . . Years held ☐

9. Is this lease arrangement with a relative? ☐ YES ☐ NO

10. For this lease, I'd like to know what services you, the landowner, provides. I will read you a list of specific services and you can tell me if you provide nothing, materials only, labor only, materials and some labor, or i you cover all costs:

Landlord Provides:	Nothing	Materials Only	Labor Only	Materials, Some Labor	All Costs	Other: Specify Below
a. Fence construction						
b. Fence maintenance						
c. Irrigation system(s)						
d. Buildings & machinery storage						
e. Grain storage						
f. Weed control						
g. Insect & disease control						
h. Fertilizer						

OTHER COST ARRANGEMENTS ____________________

____

11. Is there a noxious weed problem on this lease? ☐ YES ☐ NO

If Yes, what was the actual cost to you, the landlord, over the last twelve months of weed control on this lease including your labor and equipment? . . . . Total Dollars ☐

12. Does your tenant essentially have the right to manage grazing on this lease as if it was his own land in terms of contolling stocking rates, on-off dates, and other aspects of the timing of the grazing use? ☐ YES ☐ NO

COMMENTS:____

13. For the type of livestock your tenant runs on this lease, what is the average per head ending sale weight f the ranch?

	Average Ranch Ending Sale Weight Lbs.	Are the average lease sale weights greater than, lighter than or equal to the average ranch weights?	Average On Weight Lbs	Average Off Weight Lbs.	Is this a fairly accurate estimate an specific to productio on this Lease? Yes or No
Calves					
Yearlings					
Lambs					

14. Is there a lease provision for the survivability of your tenant's livestock on this lease? For example, does t lease agreement ensure that the tenant will receive some given percentage of the livestock turned out or some compensation for losses? ☐ YES ☐ NO

If YES, what are the terms of this survivability lease provision? (please check)

	Guaranteed percentage come off lease
	Dollar or other compensation for loss

Any comments concerning the terms of survivability? ______________________________

____

15. In your experience with this lease, what percentage of the livestock your tenant turns out on this lease w come off?

Type of Livestock	Percent Survived
Calves	
Cows	
Yearlings	
Lambs	
Ewes	

16. What has been the average conception rate for your tenant's livestock that have been turned out on this lease?

	Percent that conceive?	Is this a fairly accurate estimate specific to this lease? Yes or N
Percentage conception rate for all COWS turned out		
Percentage conception rate for all EWES turned out		

17. How would you rate the productivity of this lease on a scale of: ☐ excellent, ☐ good, ☐ fair, or ☐ poor?

18. How would you rate the forage quality concerning this lease on a scale of: ☐ excellent, ☐ good, ☐ fair, or ☐ poor?

19. How would you rate the water quantity and location concerning this lease on a scale of: ☐ excellent, ☐ good, ☐ fair, ☐ poor or ☐ No water on lease?

20. With regard to water supply, how would you rate the water quality concerning this lease on a scale of: ☐ excellent, ☐ good, ☐ fair, or ☐ poor?

21. How would you rate the performance of this lease under drought conditions on a scale of: ☐ excellent, ☐ good, ☐ fair, or ☐ poor?

22. Do you, the landlord, control public access for fishing or hunting on this lease? ☐ YES ☐ NO

If Yes, do you allow access for hunting or fishing on this lease? ☐ YES ☐ NO

If Yes, do you :
- ☐ Allow people to hunt and fish for free
- ☐ Charge a fee: .... Dollars per day ☐
  (Add comment if not charged per day) ______
- ☐ Sublease to an outfitter .... Dollar Amount ☐
- ☐ Allow entry under block management
- ☐ Other (specify) ______

If No, does your tenant allow access for hunting or fishing on this lease? ☐ YES ☐ NO

If Yes, does tenant:
- ☐ Allow people to hunt and fish for free
- ☐ Charge a fee: .... Dollars per day ☐
  (Add comment if not charged per day) ______
- ☐ Sublease to an outfitter .... Dollar Amount ☐
- ☐ Allow entry under block management
- ☐ Other (specify) ______

NOTE: SECTION C MAY NEED TO BE COMPLETED FOR ONE MORE LEASE, SEE INSTRUCTIONS.

SECTION F - GENERAL QUESTIONS ON LEASING (for all respondents)

1. Which of the following is the most commonly used method of charging for grazing on privately owned non-irrigated grazing land in your area? What is the average charge for this method in your area?

√ Only One	Most common method of charging	Average charge for this method
	AUM or cow/calf pair	
	Fee per head, yearlings	
	Fee per head, sheep	
	Acre	
	Ranch	
	Other:	

2. Do you think that in your area a fair price for state grazing leases would be 100 percent of the average price reported in question 1?

☐ YES

☐ NO, Ask 2A and then 2B below.

2A. What is the main reason you think state leases should be prices below the market?

MAIN REASON: ____________________

____

2B. For comparable ground, terms and services, what do you think would be a fair price for leasing grazing land on average state school trust lands in your area as a percentage of the price you reported in question 1? __________ percent

3. How would you rank the desirability of a federal versus a state versus a private agricultural lease if they w all on comparable ground? Select one.

☐ 1. Federal best, state so-so, private worst
☐ 2. Federal best, state worst, private so-so
☐ 3. Federal so-so, state best, private worst
☐ 4. Federal so-so, state worst, private best
☐ 5. Federal worst, state best, private so-so
☐ 6. Federal worst, state so-so, private best

4. Suppose that there was a state lands grazing lease in your area that could work well in your livetock operation, but the lease is currently held by a neighbor, at the time of lease renewal, would you submit a competitive bid? Select one.

☐ 1. I would submit a bid
☐ 2. I might submit a bid
☐ 3. I would not submit a bid out of consideration for my neigh
☐ 4. Other action (specify) ____________________

5. Are there any other comments you would care to make on the issue of grazing leasing rights in Montana?

____

____

6. Would you like to receive a copy of the results of this survey? ☐ YES ☐ NO

NAME ____________________ DATE ____________________ PHONE __________

APPENDIX F. July Cattle Survey instrument, Agricultural Statistics Service (annual).

AGRICULTURAL
STATISTICS
SERVICE

P.O. Box 4369
Helena, Montana 59604

1992
JULY CATTLE SURVEY

O.M.B. Number
Approval Expire
Project Code 15

Montana

Optional	C
407	40

Dear Reporter:

Information requested in this survey to prepare agricultural estimates. Fac your farm or ranch are confidential a only in combination with similar repo other producers. Response is voluntar

Sincerely,

James K. Sands

James K. Sands
State Statistician

ATTEMPTED CONTACTS		
Date	Time	Notes

Stratum	ID	Tract	Subtr.

SECTION 1 - IDENTIFICATION

Please verify name and address of this operation. Make corrections on label.

1. On land operated by the farm, ranch or individual*(s)* listed on the label:

   a. Have or will crops, including fruit, vegetables, and nursery products, be grown or hay cut at any time during 1992, or is any of the land in this operation in government programs? . . . . ☐ YES ☐ NO

   b. Have or will grains or oilseeds be stored at any time during 1992, or do you have storage facilities used for storing grain? . . . . ☐ YES ☐ NO

   c. Have or will there be any cattle or calves on this operation at any time during 1992? . . . . ☐ YES ☐ NO

   d. Have or will there be any hogs, sheep, goats, other livestock, or poultry on this operation at any time during 1992? . . . . ☐ YES ☐ NO

   → If NO to all questions, GO TO SECTION 6.

2. Does this operation do business under any name, other than as shown on label?

   ☐ YES - Enter name: ____________________

   Do you want this name to appear on the label? ☐ YES ☐ NO

   ☐ NO

3. Are the day-to-day decisions for this farming *(or ranching)* operation made by an individual, partners, or a hired manager?

   ☐ Individual Operator

   ☐ Partners - Enter number of partners, including self . . . ☐
   (Partners jointly operate land and share in decision making. DO NOT include landlord as partner.)

   ☐ Hired Manager

3a. Are the decisions still made by the same person*(s)* making them on June 1, 1991?

   ☐ YES ☐ NO - *Would you please explain what changed?*

   ____

   ____

Office U
R. Uni
921
Chang
923
Sub.
941

SECTION 3 - CATTLE AND CALVES

1. On July 1, were any **CATTLE** and **CALVES**, regardless of ownership, on the total acres operated? *(Include Cattle and Calves owned or managed on land administered or controlled by a public agency, industrial corporation, or grazing association on a fee per head or animal unit month (AUM) basis.)*

☐ YES ☐ NO ⟶ a. Were any **CATTLE** or **CALVES** on the total acres operated, at any time, during the period of January 1, 1992 through June 30, 1992?

YES ☐ - *GO TO Item 10.* NO ☐ - *GO TO Section 4, on next page.*

Of the total cattle and calves on hand July 1, how many were:

2. **BEEF COWS**, including heifers that have calved?	351	★
3. **MILK COWS**, whether dry or in milk, including milk heifers that have calved?	352	★
4. **BULLS** weighing 500 pounds or more?	353	★
5. **HEIFERS** that had not calved, weighing 500 pounds or more:		
a. For **BEEF COW** replacement? . . .	354	★
b. For **MILK COW** replacement? . . .	355	★
c. **OTHER HEIFERS** 500 pounds or more?	356	★
6. **STEERS** weighing 500 pounds or more?	357	★
7. **HEIFER, STEER** and **BULL CALVES** weighing less than 500 pounds? *(Include newborn calves)*	358	★
8. Then the **TOTAL CATTLE and CALVES** on hand July 1 was *(Add ★ Items 2 through 7)*	350	

Is that correct? [IF NOT, MAKE CORRECTION]

Continue with Item 9 in next column.

(For Items 9-13 include births and deaths of cattle and calves on Public, Industrial, or Grazing Association lan

CALF CROP FOR 1992

9. Of the cows and heifers on the total acres operated on July 1, how many are **EXPECTED TO CALVE** during the period July 1 through December 31, 1992?	361
10. Of the **CALVES BORN** on the total acres operated during the period January 1, through June 30, 1992 how many: *(Exclude calves purchased)*	
a. Were on hand July 1?	363
b. Were sold, moved off total acres operated, or slaughtered before July 1?	364
c. Had died before July 1? *(Exclude calves born dead)*	365
11. Then the **TOTAL CALVES BORN** January 1, through June 30, 1992 was: *(Add ★ Items 10a + 10b + 10c)*	362

DEATHS

12. How many **CATTLE** weighing 500 lbs. or more died or were lost from all causes during the period of January 1 through June 30, 1992?	367
13. How many **CALVES** weighing less than 500 lbs. died or were lost from all causes during the period of January 1 through June 30, 1992?	368

GRAZING FEES

14. Which of the following is the most commonly used method of charging for grazing on privately owned, non-irrigated grazing land in your area: Per Head Per Month, Per Animal Unit Month (AUM), or Per Cow With Nursing Calf Per Month?

(Check appropriate box)
☐ Per Head Per Month = 5
☐ Per Animal Unit Month (AUM) = 7
☐ Per Cow With Nursing Calf Per Month = 9

What is the average charge for this method in your area?. . . . . Dollars & Cents 91__ . __

15. During 1992, will this operation pay a fee to graze cattle on privately owned, non-irrigated land? . . . . (☐ YES = 1 ☐ NO = 3) ⟶ 908

1 - Incomplete, Has Cattle 2 - Incomplete, Cattle Presence Unknown 3 - Valid Zero	498

Continue On Next Page

APPENDIX G. Montana FIPS District codes and counties.

APPENDIX G.

Table G-1. FIPS District Codes.

Code 10	Deerlodge, Flathead, Granite, Lake, Lincoln, Mineral, Missoula, Powell, Ravalli, Sanders.
Code 20	Blaine, Chouteau, Glacier, Hill, Liberty, Phillips, Pondera, Teton, Toole.
Code 30	Daniels, Dawson, Garfield, McCone, Richland, Roosevelt, Sheridan, Valley.
Code 50	Broadwater, Cascade, Fergus, Golden Valley, Judith Basin, Lewis & Clark, Meagher, Musselshell, Petroleum, Wheatland.
Code 70	Beaverhead, Gallatin, Jefferson, Madison, Silverbow.
Code 80	Bighorn, Carbon, Park, Stillwater, Sweet Grass, Treasure, Yellowstone.
Code 90	Carter, Custer, Fallon, Powder River, Prairie, Rosebud, Wibaux.

Appendix H. Statistical Tables.

Hedonic Model . Analysis of Variance.

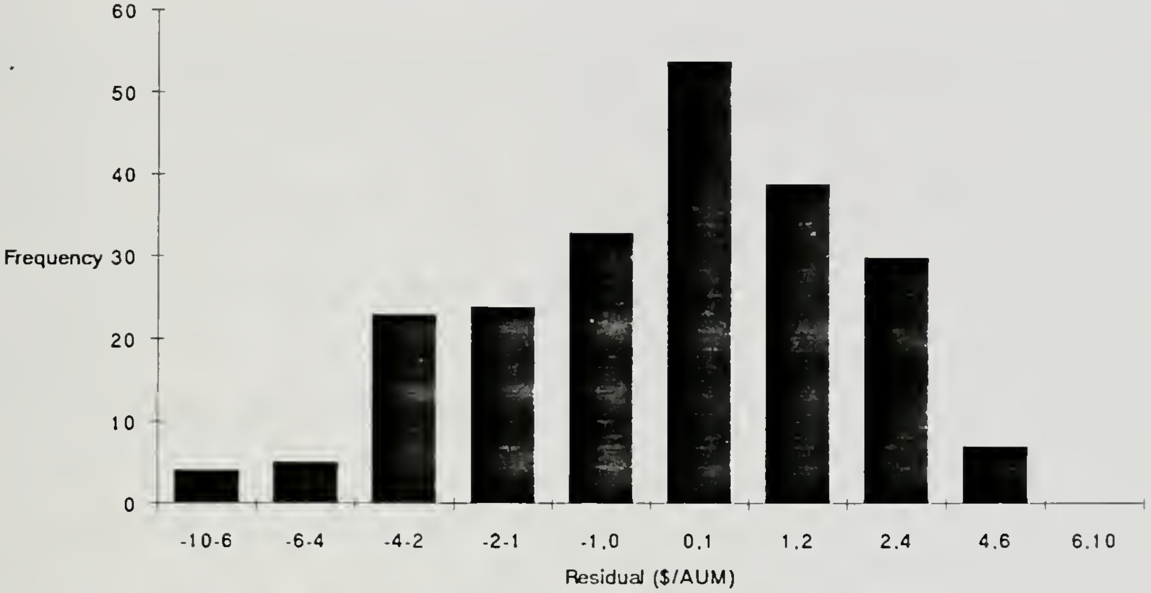
Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	7	513.68	73.38	13.25	0.0001
Error	223	1235.26	5.54		
Total	230	1748.94			

Root MSE	2.35	R-square	0.29
Dep Mean	11.33	Adj R-sq	0.27
C.V.	20.78		

Hedonic Model . Parameter Estimates.

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INT	1	9.548	0.339	28.141	0.0001
D30	1	-0.854	0.473	-1.806	0.0724
D50	1	1.600	0.430	3.723	0.0003
F25	1	1.437	0.369	3.896	0.0001
W25	1	0.954	0.359	2.658	0.0085
T1	1	1.747	0.634	2.756	0.0064
H1	1	0.752	0.386	1.947	0.0528
L5	1	-1.940	0.751	-2.584	0.0104

APPENDIX H Statistical Tables (Cont'd).
Distribution of Residuals for the Hedonic Model, Full Sample.



The unstandardized residuals of reduced model using the full sample of private leases are shown above. The distribution approximates normal, although there are a number of observations in the -10 to -6 cell which are not represented in the corresponding +6 to +10 cell.

APPENDIX I. Hedonic Model Summary Statistics for Predicted and Actual (or Reported) Values.

Table I-1. Actual, Predicted AUM prices for State leases.

Variable	N	Min	Max	Mean	Std Dev
Predicted	292	6.75	12.59	8.16	1.15
Actual-Pred	292	-8.42	16.56	-3.42	2.53
Actual	292	4.17	24.17	4.74	2.24

APPENDIX J (Cont'd).

Table J-2. Coding Key for Categorical Variables

VALUE TYPE_4F

1='YES'
3='NO'

Variables: BOWNBOS0, CONFDN00, CONFID00, CONFID01, CONFID02, CONFID03, FAIRPRCE,FENCED0, HUNTFSH3, HUNTFSH7 INDIC000, INDIC001, INDIC002, LMTSMKT0, NOXSWEE0, PBLCACC0, PROVISO0, RELATIV0, SUBLEA00, SUBLEA01, SUBLEA02, SURROU00.

VALUE TYPE_8F

1='Operator'
2='Spouse'
3='Other' Variables: RESPNDNT

VALUE TYPE_9F

1='Cow/Calf'
2='Yearlings'
3='Sheep and Lambs'
4='Hogs and Pigs'
5='Other Livestock'
6='No livestock whatsoever on unit'

Variables: TYPEOFOP

VALUE TYPE_10F

1='Dryland'
2='Sub irrigated'
3='Irrigated'

Variables: TYPELAN0

VALUE TYPE_11F

1='Animal Unit Month '
2='On a Per Head'
3='By the Acre'
4='By the Ranch'
5='None of the above!!'

Variables: TYPECHR0

VALUE TYPE_12F, 13_F,14_F

1='Nothing'
2='Materials Only'
3='Labor Only'
4='Materials and some Labor'
5='All of the Costs'
6='None of the above sharing arrangements'

Variables: FNCECNS0, FNCEMAI0, WATRDVL0, BLDGCRR0, HERDMNG0, WEEDCNT0

VALUE TYPE_18F, 19_F,21_F

1='Excellent'
2='Good'
3='Fair'
4='Poor'

Variables: PRDCTVT0, FRGEQLT0, WATRQLT0, DRTHPRF0

VALUE TYPE_20F

1='Excellent'
2='Good'
3='Fair'
4='Poor'
5='No water on the lease' Variables: WATRQNT0

APPENDIX J (Cont'd).

Table J-2. Coding Key for Categorical Variables

VALUE TYPE_23F, 24_F

1='Allow people to hunt and fish for free'
2='Charge people a fee to hunt or fish'
3='Sublease to an Outfitter'
4='Allow entry under Block Management'
5='Other situtation'

Variables: ACTIVTY3, ACTIVTY7

VALUE TYPE_25F

1='Greater than Ranch'
2='Less than Ranch'

Variables: MORELE01, MORELE02, MORELE03

VALUE TYPE_26F

1='Guaranteed percentage come off lease'
2='Dollar or other compensation for loss'

Variables: TERMS0

VALUE TYPE_27F

1='State'
2='Bureau of Land Management'
3='Forest Service'
4='Bureau of Indian Affairs'
5='Other' Variahles: ID

VALUE TYPE_28F

1='Inholding Status'
2='Cost of Enclosure'
3='Neighbor Relations'
4='Other'

VALUE TYPE_29F

1='Open Access'
2='By Permission Only'
3='Block Management'
4='Generally Closed'
5='Othr'

VALUE TYPE_30F

1='Animal Unit Month'
2='On a Per Head'
3='By the Acre'
4='By the Ranch'
5='None of the above!!' Variables: TYPECHR6

VALUE TYPE_31F

1='Federal best, State so-so, Private worst'
2='Federal best, State worst, Private so-so'
3='Federal so-so, State best, Private worst'
4='Federal so-so, State worst, Private best'
5='Federal worst, State best, Private so-so'
6='Federal worst, State so-so, Private best'

Variables: RANK

VALUE TYPE_32F

1='I WOULD submit a bid'
2='I MIGHT submit a bid'
3='I would NOT submit a bid out of consider'
4='Other action'
Variables: WOULDYOU

APPENDIX K .

Table K-1. Variables of the Grazing Database.

-----Alphabetic List of Numeric Variables and Attributes-----

#	Variable	Type	Len	Pos	Format	Label
39	ACRES0	Num	8	308		Acres of lease
26	ACRESCA0	Num	8	204		Number of Acres in private Lease
28	ACRESCA1	Num	8	220		Number of Acres in state Lease
30	ACRESCA2	Num	8	236		Number of Acres in BLM Lease
32	ACRESCA3	Num	8	252		Number of Acres in Forest Service Lease
34	ACRESCA4	Num	8	268		Number of Acres in BIA Lease
36	ACRESCA5	Num	8	284		Number of Acres in Other Lease
38	ACRESCA6	Num	8	300		Number of Acres in Cooperative Lease
113	ACRESGRZ	Num	8	900		Acres of Grazing rented out.
108	ACTIVTY3	Num	8	860	TYPE_23F.	What does he allow
112	ACTIVTY7	Num	8	892	TYPE_24F.	What does landlord allow
56	AMNTCHR0	Num	8	444		The rate of the basis
116	AMNTCHR6	Num	8	924		The rate of the most common method of charging
139	BIDHIGH0	Num	8	1108		
66	BLDGCRR0	Num	8	524	TYPE_15F.	Services for Buildings and Corrals
71	BOWNBOS0	Num	8	564	TYPE_4F.	Can he manage land as wants
92	CALVES0	Num	8	732		Percent of calves surviving
129	CMPTNG00	Num	8	1028		
100	CONFDN00	Num	8	796	TYPE_4F.	Confidence of Ewes Pregnant
77	CONFID00	Num	8	612	TYPE_4F.	Confidence of ON-OFF Weights
83	CONFID01	Num	8	660	TYPE_4F.	Confidence of ON-OFF Weights
89	CONFID02	Num	8	708	TYPE_4F.	Confidence of ON-OFF Weights
98	CONFID03	Num	8	780	TYPE_4F.	Confidence of Cows Pregnant
2	COUNTY	Num	8	12		FIPS code for county
93	COWS0	Num	8	740		Percent of cows surviving
97	COWSPRE0	Num	8	772		Conception Rate for Cows
19	COW_CALF	Num	8	148		Number of cows & calf pairs
16	CROPLAND	Num	8	124		Acres of cropland
17	CRP	Num	8	132		Acres of CRP
125	DATECOMP	Num	8	996		Date Completed
146	DELWGT	Num	8	1164		Animal Weight Gain
42	DISTANC0	Num	8	332		Surrounded Inholding UNfenced Distance
1	DISTRICT	Num	8	4		FIPS code for District
105	DRTHPRF0	Num	8	836	TYPE_22F.	Performance in Drought Conditions
15	ESTIMATE	Num	8	116		
96	EWES0	Num	8	764		Percent of ewes surviving
99	EWESPRE0	Num	8	788		Conception Rate for Ewes
119	FAIRPRCE	Num	8	948	TYPE_4F.	Fair price state grazing land
141	FEEHDRY6	Num	8	1124		
58	FEEHDSH0	Num	8	460		Fee per head for Sheep
118	FEEHDSH6	Num	8	940		Fee per head for Sheep
57	FEEHDYR0	Num	8	452		Fee per head for yearlings
117	FEEHDYR6	Num	8	932		Fee per head for yearlings
142	FEEHYDR6	Num	8	1132		

APPENDIX K (Cont'd) .

Table K-1. Variables of the Grazing Database.

-----Alphabetic List of Numeric Variables and Attributes-----

#	Variable	Type	Len	Pos	Format	Label
41	FENCED0	Num	8	324	TYPE_4F.	Surrounded Inholding Fenced
63	FNCECNS0	Num	8	500	TYPE_12F.	Services for Fence Construction
64	FNCEMAI0	Num	8	508	TYPE_13F.	Services for Fence Maintenance
102	FRGEQLT0	Num	8	812	TYPE_19F.	Rate Forage Quality
138	FRSTYEA0	Num	8	1100		
60	HELD0	Num	8	476		Number of years lease held
67	HERDMNG0	Num	8	532	TYPE_16F.	Services for Herd Management
23	HOGSPIGS	Num	8	180		Number of Hogs and Pigs
134	HUNTFIS0	Num	8	1068		
107	HUNTFSH3	Num	8	852	TYPE_4F.	Allow Access
111	HUNTFSH7	Num	8	884	TYPE_4F.	Does landlord allow access
126	ID	Num	8	1004		Lease Identification
130	IFNOW000	Num	8	1036		
131	IFNOW001	Num	8	1044		
132	IFNOW002	Num	8	1052		
133	IFNOW003	Num	8	1060		
73	INDIC000	Num	8	580	TYPE_4F.	Indicative of Lease
79	INDIC001	Num	8	628	TYPE_4F.	Indicative of Lease
85	INDIC002	Num	8	676	TYPE_4F.	Indicative of Lease
95	LAMBS0	Num	8	756		Percent of lambs surviving
136	LEGLACC0	Num	8	1084		
59	LGTHTER0	Num	8	468		Number of years for lease
12	LIFMACRE	Num	8	92		Land in Farm
43	LMTSMKT0	Num	8	340	TYPE_4F.	Location limiting marketability
137	LRGLACC0	Num	8	1092		
53	MONTHS0	Num	8	420		Months for typical year
74	MORELE00	Num	8	588	TYPE_25F.	Is production greater or less than ranch
80	MORELE01	Num	8	636	TYPE_25F.	Is production greater or less than ranch
86	MORELE02	Num	8	684	TYPE_25F.	Is production greater or less than ranch
114	NMGRZLS	Num	8	908		Number of Grazing leases.
69	NOXSWEE0	Num	8	548	TYPE_4F.	Noxious Weed Problem?
70	NOXWDCS0	Num	8	556		Cost of Noxious Weed Control
25	NUMBER0	Num	8	196		Number of Leases
27	NUMBER1	Num	8	212		Number of Leases
29	NUMBER2	Num	8	228		Number of Leases
31	NUMBER3	Num	8	244		Number of Leases
33	NUMBER4	Num	8	260		Number of Leases
35	NUMBER5	Num	8	276		Number of Leases
37	NUMBER6	Num	8	292		Number of Leases
76	OFF_00	Num	8	604		Weight the Animals Went Off
82	OFF_01	Num	8	652		Weight the Animals Went Off
88	OFF_02	Num	8	700		Weight the Animals Went Off
75	ON_00	Num	8	596		Weight the Animals Went On
81	ON_01	Num	8	644		Weight the Animals Went On

APPENDIX K (Cont'd) .

Table K-1. Variables of the Grazing Database.

-----Alphabetic List of Numeric Variables and Attributes-----

#	Variable	Type	Len	Pos	Format	Label
87	ON_02	Num	8	692		Weight the Animals Went On
24	OTHER	Num	8	188		Number of Other
21	OTHRBEEF	Num	8	164		Number of Other Beef
110	OUTFITT0	Num	8	876		Dollar Amount Charged to Outfitter
7	OWNED	Num	8	52		Acres owned
106	PBLCACC0	Num	8	844	TYPE_4F.	Control of Public Access
120	PCTOFAVG	Num	8	956		State schl trust land as percent of avg.
109	PEOPLE0	Num	8	868		Dollar Amount Charged for Hunt-Fish
10	PIGA	Num	8	76		PIGA Acres
101	PRDCTVT0	Num	8	804	TYPE_18F.	Rate Productivity
90	PROVISO0	Num	8	716	TYPE_4F.	Lease Provision for Survivability
121	RANK	Num	8	964	TYPE_31F.	Comparison rank of fed. state, prvte lease
61	RELATIV0	Num	8	484	TYPE_4F.	Lease with Relative
8	RENTFROM	Num	8	60		Acres rented from
9	RENTTO	Num	8	68		Acres rented out
6	RESPNDNT	Num	8	44	TYPE_8F.	Respondent code.
124	RESULTS	Num	8	988	TYPE_4F.	Results to operator
72	SALEWG00	Num	8	572		Average Ending Sale Weight
78	SALEWG01	Num	8	620		Average Ending Sale Weight
84	SALEWG02	Num	8	668		Average Ending Sale Weight
22	SHEEP	Num	8	172		Number of Sheep
46	SUBLEA00	Num	8	364	TYPE_4F.	Check for lease being part of larger pas
49	SUBLEA01	Num	8	388	TYPE_4F.	Check for lease being part of larger pas
52	SUBLEA02	Num	8	412	TYPE_4F.	Check for lease being part of larger pas
40	SURROU0	Num	8	316	TYPE_4F.	Surrounded Inholding
91	TERMS0	Num	8	724	TYPE_26F.	Terms of Survivability Provision
11	TOTLACRE	Num	8	84		Acres Operated
55	TYPECHR0	Num	8	436	TYPE_11F.	How are charges reckoned
115	TYPECHR6	Num	8	916	TYPE_30F.	Most common method of charging
54	TYPELAN0	Num	8	428	TYPE_10F.	Practice of land, irr, subirr, or dryland
18	TYPEOFOP	Num	8	140	TYPE_9F.	Type of Ranch
65	WATRDVL0	Num	8	516	TYPE_14F.	Services for Water Development
104	WATRQLT0	Num	8	828	TYPE_21F.	Rate Water Quality
103	WATRQNT0	Num	8	820	TYPE_20F.	Rate Water Quantity
68	WEEDCNT0	Num	8	540	TYPE_17F.	Services for Weed Control
122	WOULDYOU	Num	8	972	TYPE_32F.	Would you submit bid against neighbor?
147	D10	Num	8	1172		Dummy (0/1) for District=10
148	D20	Num	8	1180		Dummy (0/1) for District=20
149	D30	Num	8	1188		Dummy (0/1) for District=30
150	D50	Num	8	1196		Dummy (0/1) for District=50
151	D70	Num	8	1204		Dummy (0/1) for District=70
152	D80	Num	8	1212		Dummy (0/1) for District=80
20	YEARLIN0	Num	8	156		Number of Yearlings
94	YEARLIN1	Num	8	748		Percent of yearlings surviving

APPENDIX L .

Table L-1. Univariate Correlations of AUM Rate and Continuous Variables of the Grazing Database.

Pearson Correlation Coefficients / Prob > |R| under Ho: Rho=0 / Number of Observations

Variable	Pearson r	Prob	n
DISTRICT	-0.06248	0.1362	570
COUNTY	-0.04144	0.3234	570
OWNED	-0.25363	0.0001	565
RENTFROM	-0.02807	0.5055	565
RENTTO	0.02000	0.6344	568
PIGA	-0.16458	0.0002	509
TOTLACRE	-0.21228	0.0001	561
LIFMACRE	-0.25074	0.0001	561
CROPLAND	-0.00071	0.9866	562
CRP	-0.06321	0.1334	565
TYPEOFOP	0.04040	0.3357	570
COW_CALF	-0.19090	0.0001	562
YEARLIN0	-0.07785	0.0644	565
OTHRBEEF	-0.14868	0.0004	561
SHEEP	-0.14702	0.0005	563
HOGSPIGS	0.03814	0.3656	565
OTHER	0.04514	0.2837	566
NUMBER0	0.34214	0.0001	567
ACRESCA0	-0.13522	0.0140	330
NUMBER1	-0.21816	0.0001	568
ACRESCA1	-0.06552	0.2816	272
NUMBER2	-0.34233	0.0001	567
ACRESCA2	-0.09181	0.1983	198
NUMBER3	-0.23550	0.0001	568
ACRESCA3	-0.06391	0.6019	69
NUMBER4	0.05184	0.2177	567
ACRESCA4	-0.25455	0.1130	40
NUMBER5	-0.07545	0.0724	568
ACRESCA5	-0.30506	0.2506	16
NUMBER6	-0.06669	0.1124	568
ACRESCA6	-0.42667	0.5733	4
ACRES0	-0.13735	0.0018	514
SURROU00	0.05555	0.1854	570
FENCED0	-0.30006	0.0011	116
DISTANC0	0.25732	0.0001	449
LMTSMKT0	0.16460	0.0004	451

APPENDIX L (Cont'd).

Table L-1. Univariate Correlations of AUM Rate and Continuous Variables of the Grazing Database.

Pearson Correlation Coefficients / Prob > |R| under Ho: Rho=0 / Number of Observations

Variable	Pearson r	Prob	n
SUBLEA00	0.18622	0.4190	21
SUBLEA01	.	.	7
SUBLEA02	.	.	3
MONTHS0	0.16125	0.0001	562
TYPELAN0	0.22523	0.0001	567
LGTHTER0	-0.10422	0.0144	551
HELD0	-0.49379	0.0001	562
RELATIV0	-0.00311	0.9612	248
FNCECNS0	0.46426	0.0001	568
FNCEMAI0	0.46399	0.0001	567
WATRDVL0	0.30611	0.0001	569
BLDGCRR0	0.40930	0.0001	570
HERDMNG0	0.36103	0.0001	570
WEEDCNT0	0.27533	0.0001	562
NOXSWEE0	0.10636	0.0113	566
NOXWDCS0	0.09268	0.2796	138
BOWNBOS0	-0.06539	0.1205	565
SALEWG00	0.22581	0.0002	276
INDIC000	-0.11612	0.0162	428
MORELE00	-0.32955	0.0182	51
ON_00	-0.01697	0.7386	389
OFF_00	0.20510	0.0001	397
CONFID00	-0.02470	0.6125	423
SALEWG01	0.21472	0.0590	78
INDIC001	-0.19226	0.0442	110
MORELE01	.	.	6
ON_01	0.13868	0.1448	112
OFF_01	0.40628	0.0001	109
CONFID01	0.04186	0.6512	119
SALEWG02	-0.24295	0.3313	18
INDIC002	-0.13743	0.4610	31
MORELE02	0.68308	0.3169	4
ON_02	-0.34206	0.0872	26
OFF_02	-0.02458	0.9051	26
CONFID02	-0.10581	0.5779	30
PROVISO0	-0.08221	0.0506	566
TERMS0	0.80678	0.0989	5
CALVES0	0.19816	0.0001	434

APPENDIX L (Cont'd).

Table L-1. Univariate Correlations of AUM Rate and Continuous Variables of the Grazing Database.

Pearson Correlation Coefficients / Prob > |R| under Ho: Rho=0 / Number of Observations

Variable	Pearson r	Prob	n
COWS0	0.24447	0.0001	435
YEARLIN1	0.15760	0.0679	135
LAMBS0	0.19271	0.3166	29
EWES0	0.16041	0.3971	30
COWSPRE0	-0.00086	0.9863	398
CONFID03	-0.00409	0.9352	397
EWESPRE0	0.19974	0.3178	27
CONFDN00	-0.07808	0.6987	27
PRDCTVT0	-0.22536	0.0001	563
FRGEQLT0	-0.16075	0.0001	563
WATRQNT0	-0.31345	0.0001	563
WATRQLT0	-0.24837	0.0001	519
DRTHPRF0	-0.23973	0.0001	558
PBLCACC0	0.17431	0.0060	247
HUNTFSH3	0.09438	0.5101	51
ACTIVTY3	-0.03202	0.8466	39
PEOPLE0			0
OUTFITT0			0
HUNTFSH7	0.00812	0.9168	168
ACTIVTY7	-0.09293	0.3976	85
ACRESGRZ	0.16483	0.3440	35
NMGRZLS	0.30190	0.1835	21
TYPECHR6	-0.17247	0.0001	545
AMNTCHR6	0.36477	0.0001	381
FEEHDYR6	0.30433	0.0253	54
FEEHDSH6	-0.29737	0.3238	13
FAIRPRCE	-0.15972	0.0008	439
PCTOFAVG	0.08765	0.1973	218
RANK	0.12305	0.0073	475
WOULDYOU	-0.20580	0.0001	561
ID	-0.45694	0.0001	567
DELWGT	0.18532	0.0003	377
PCTWGT	0.15927	0.0019	377

APPENDIX M. Competitive Bids and Acreage of State Grazing Leases.

Statewide Competitive Bid Summary (MTCOMBID.WK1)

Last Update 19-Oct-92

	Total	Grazing Land				Ag Land			
COUNTY	Bids	#	Average	High	Low	#	Average	High	Low
BEAVERHEAD	15	15	$6.91	$14.00	$4.17	0			
BIG HORN	17	17	$9.65	$19.07	$4.17	0			
BLAINE	17	17	$6.90	$16.18	$4.17	1	26.00%	26.00%	26.00%
BROADWATER	8	8	$11.17	$21.86	$5.50	1	25.00%	25.00%	25.00%
CARBON	23	23	$10.51	$18.70	$4.27	5	31.73%	42.00%	25.00%
CARTER	8	8	$8.28	$13.17	$4.17	1	28.00%	28.00%	28.00%
CASCADE	27	24	$10.80	$44.68	$4.17	10	33.39%	40.00%	25.00%
CHOUTEAU	38	13	$7.87	$15.04	$4.17	21	35.52%	42.00%	30.00%
CUSTER	8	7	$6.40	$20.75	$4.23	1	34.00%	34.00%	34.00%
DANIELS	7	3	$4.17	$4.17	$4.17	7	35.66%	40.00%	34.00%
DAWSON	22	19	$8.14	$30.00	$4.17	15	33.98%	40.00%	30.00%
DEER LODGE	1	1	$5.43	$5.43	$5.43	0			
FALLON	4	4	$6.15	$9.17	$4.17	3	36.67%	50.00%	25.00%
FERGUS	36	33	$8.18	$14.17	$4.17	11	34.51%	50.00%	25.00%
FLATHEAD	0	0				0			
GALLATIN	14	14	$6.15	$29.97	$4.17	4	25.00%	25.00%	25.00%
GARFIELD	14	14	$8.53	$13.42	$4.24	1	30.00%	30.00%	30.00%
GLACIER	4	2	$9.36	$12.09	$9.21	2	34.17%	35.00%	33.33%
GOLDEN VALLEY	8	8	$10.70	$15.27	$5.27	4	31.67%	33.33%	30.00%
GRANITE	2	2	$9.78	$11.17	$7.71	0			
HILL	33	17	$7.77	$13.17	$4.17	23	34.37%	41.00%	25.00%
JEFFERSON	10	10	$8.26	$34.67	$4.28	0			
JUDITH BASIN	16	14	$10.93	$19.47	$6.51	9	37.88%	50.00%	27.63%
LAKE	0	0				0			
LEWIS & CLARK	17	17	$10.72	$18.17	$6.09	2	32.55%	40.10%	25.00%
LIBERTY	12	8	$10.45	$12.00	$6.91	8	35.12%	51.00%	30.00%
LINCOLN	0	0				0			
MADISON	9	9	$8.65	$13.18	$4.27	0			
McCONE	22	21	$7.15	$13.42	$4.17	2	29.17%	33.33%	25.00%
MEAGHER	6	6	$5.63	$173.89	$4.26	1	35.10%	35.10%	35.10%
MINERAL	1	1	$4.30	$4.30	$4.30	1	25.00%	25.00%	25.00%
MISSOULA	1	1	$5.18	$5.18	$5.18	0			
MUSSELSHELL	11	11	$7.41	$15.00	$4.17	1	30.00%	30.00%	30.00%
PARK	13	13	$10.63	$26.01	$6.27	5	31.33%	40.00%	25.00%
PETROLEUM	6	6	$7.90	$12.05	$4.17	0			
PHILLIPS	22	21	$7.25	$37.30	$4.17	4	37.50%	51.00%	25.00%
PONDERA	15	5	$10.93	$12.37	$7.50	10	37.58%	43.00%	27.00%
POWDER RIVER	3	3	$4.41	$4.81	$4.21	0			
POWELL	6	6	$10.75	$21.00	$4.50	1			
PRAIRIE	8	7	$9.95	$15.53	$6.00	2	30.00%	35.00%	25.00%
RAVALLI	7	7	$6.84	$14.17	$5.35	1	30.00%	30.00%	30.00%
RICHLAND	21	21	$9.10	$16.34	$4.17	8	37.08%	50.00%	30.00%
ROOSEVELT	9	6	$9.86	$20.97	$4.20	5	42.00%	50.00%	40.00%
ROSEBUD	27	27	$6.92	$13.30	$4.25	2	28.00%	30.00%	26.00%
SANDERS	3	3	$9.67	$26.20	$6.01	1	25.00%	25.00%	25.00%
SHERIDAN	16	14	$7.22	$12.29	$4.17	9	34.15%	42.00%	25.00%
SILVER BOW	1	1	$9.30	$9.30	$9.30	0			
STILLWATER	16	14	$9.24	$15.79	$6.00	6	35.83%	50.00%	25.00%
SWEET GRASS	11	11	$8.68	$15.00	$4.85	0			
TETON	15	15	$10.40	$22.17	$4.17	4	37.92%	60.00%	25.00%
TOOLE	27	20	$7.23	$12.03	$4.17	9	37.18%	50.00%	30.00%
TREASURE	4	4	$6.85	$9.17	$5.33	0			
VALLEY	21	17	$9.06	$17.00	$4.17	9	36.43%	41.60%	25.00%
WHEATLAND	18	18	$10.61	$20.00	$6.15	2	33.67%	34.00%	33.33%
WIBAUX	10	10	$8.73	$13.00	$4.17	5	34.66%	40.00%	33.33%
YELLOWSTONE	19	17	$9.06	$14.17	$4.17	7	33.33%	40.00%	25.00%

STATEWIDE SUMMARY

Total	Grazing Land				Ag Land			
Bids	Total	Average	High	Low	Total	Average	High	Low
709	613	$8.34	$173.89	$4.17	224	32.91%	60.00%	25.00%

10/27/92

EPORT NO. 01
CSTLF001

TRUST LAND - LEASES AND ACREAGE BY AGREEMENT TYPE

CODE	AGREEMENT TYPE	TOTAL AGREEMENTS	TOTAL ACRES
1	GRAZING	5,698	3,397,555.151
2	GRAZING - COMPETITIVE BID	510	281,005.064
3	GRAZING - NEW/RENEWAL	5	3,200.000
100	AGRICULTURE AND GRAZING	1,893	942,285.055
101	AGRICULTURE & GRAZING - COMPETITIVE BID	166	80,042.350
200	AGRICULTURE	813	205,623.304
201	AGRICULTURE - COMPETITIVE BID	78	25,441.890
300	SPECIAL LEASES	901	9,713.597
301	SPECIAL LEASES - COMPETITIVE BID	51	971.125
303	FORESTRY AGRICULTURAL LICENSE	17	260.200
400	OIL & GAS LEASE	1,584	908,301.850
500	METALLIFEROUS	40	16,951.320
501	NON-METALLIFEROUS	22	6,764.340
502	COAL	15	6,648.090

CODE	AGREEMENT TYPE	TOTAL AGREEMENTS	TOTAL ACRES
600	EASEMENT/ROW	9,735	47,668.442
601	CERTIFICATE OF PURCHASE	64	31,901.840
	GRAND TOTALS:	20,592	5,964,333.618

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                                             ACREAGE BREAKDOWN FOR COMBINED AGRI./GRAZ. LEASES
EPORT NO. 0?
 CSTLF001

                                                                                      TOTAL ACRES

    100  AGRICULTURE AND GRAZING                                                    350,496.020
                    AGRICULTURE ACRES                                                573,610.626
                    GRAZING ACRES                                                      6,697.890
                    UNSUITABLE ACRES                                                  11,273.449
                    RESOURCE DEVELOPMENT ACRES

    101  AGRICULTURE & GRAZING - COMPETITIVE BID                                     37,784.710
                    AGRICULTURE ACRES                                                 41,013.780
                    GRAZING ACRES                                                        193.100
                    UNSUITABLE ACRES                                                   1,030.760
                    RESOURCE DEVELOPMENT ACRES
```

APPENDIX N. State Lease Verification Results.

Table N-1. State lease verification,- status of reported leases.

	Frequency	Percent (%)
Total reported leases	396	100.0
Reported as AUM leases	281	71.0
Provided price	127	32.1
Non existent	66	16.7
Annual leases	2	0.5
Agricultural leases	2	0.5
Reported 2 leases, held one	7	1.8
No current lease agreement	7	1.8
Verified state leases	315	79.5
Correct price[1]	23	7.3

1. expressed as % verified state leases.

In the original survey, 396 state grazing leases were reported by respondents. Of these 396 reported leases, 71% of the leaseholders identified the basis for charging to be an AUM; most of the remainder responded that the basis for charging was "yearly", a "flat fee", or by the acre. In fact, state grazing leases are charged on an AUM basis nearly 100% of the time, based on DSL policy.

Of the 396 reported state leases, only 32% of the respondents reported a price, irrespective of charge basis.

The 396 reported state leases were subsequently investigated directly in the DSL lease agreement records, primarily to verify reported prices and basis of charging. Of the 396 reported leases, 16.7% did not exist in DSL's records under the leasholder's name. A certain number of these may be other lease types miscoded as state; some may represent subleasing. Annual leases and agricultural each accounted for 0.5% of the reported 396 state leases. Respondents holding one lease, but reporting two, accounted for 1.8%. An additional 1.8% held no current lease agreement.

Ultimately, 315 of the original 396 reported state grazing leases could be validated. Most surprisingly, only 7.3% of these individuals were able (or willing) to quote the correct rate ($/AUM) as listed on the lease agreement.

APPENDIX O. Hedonic Model Validation Tables.

Hedonic Model for 2/3 Split Sample. Analysis of Variance.

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	6	398.26	66.38	10.11	0.0001
Error	141	925.28	6.56		
Total	147	1323.54			

Root MSE	2.56	R-square	0.30
Dep Mean	11.36	Adj R-sq	0.27
C.V.	22.54		

Hedonic Model for 2/3 Split Sample. Parameter Estimates.

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INT	1	9.73	0.440	22.188	0.0001
D30	1	-1.084	0.596	-1.818	0.0712
D50	1	1.836	0.574	3.199	0.0017
F25	1	1.346	0.499	2.698	0.0078
W25	1	1.087	0.485	2.242	0.0265
T1	1	2.203	0.798	2.762	0.0065
L5	1	-2.359	0.861	-2.740	0.0069

APPENDIX O. Hedonic Model Validation Tables (Cont'd).

Hedonic Model for 2/3 Split Sample, with "New Lease" variable.

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	7	410.33	58.62	8.986	0.0001
Error	140	913.21	6.52		
Total	147	1323.54			

Root MSE	2.55	R-square	0.31
Dep Mean	11.36	Adj R-sq	0.28
C.V.	22.47		

Hedonic Model for 2/3 Split Sample, with "New Lease" variable.

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INT	1	9.61	0.447	21.506	0.0001
D30	1	-1.023	0.596	-1.717	0.0881
D50	1	1.749	0.576	3.038	0.0028
F25	1	1.243	0.503	2.471	0.0147
W25	1	1.089	0.483	2.254	0.0257
T1	1	2.210	0.795	2.779	0.0062
L5	1	-2.201	0.866	-2.542	0.0121
H1	1	0.670	0.493	1.360	0.1760

APPENDIX P. Means for Hedonic Variables by Lease Type.

Table P-1 . Private lease min, max, means, and std. dev. for hedonic variables.

Variable	Min	Max	Mean	Std Dev	n
AUM Rate	1.04	20.00	11.33	2.757	231
District 30	0	1	0.152	0.359	231
District 50	0	1	0.190	0.394	231
Fence Maintenance	0	1	0.615	0.488	231
Water Development	0	1	0.554	0.498	231
Land Type	0	1	0.069	0.254	231
Terms > 5yrs	0	1	0.048	0.213	231
New Lease	0	1	0.238	0.427	231

Table P-2. State lease min, max, means, and std. dev. for hedonic variables.

Variable	Min	Max	Mean	Std Dev	n
AUM Rate	4.17	24.17	4.74	2.24	292
District 30	0	1	0.195	0.397	292
District 50	0	1	0.144	0.352	292
Fence Maintenance	0	1	0.058	0.235	292
Water Development	0	1	0.041	0.199	292
Land Type	0	1	0.007	0.083	292
Terms > 5 yrs	0	1	0.825	0.380	292
New Lease	0	1	0.034	0.183	292

APPENDIX Q. Logit Results for Recreational Access Hypothetical Bidding Question.

```
Response: BID                Response Levels (R)=    2
Weight Variable: None        Populations     (S)=    5
Data Set: GBID               Total Frequency (N)=  620
                             Observations  (Obs)=  620


                POPULATION PROFILES
                              Sample
             Sample   LNBID         Size
             -----------------------------------
               1      0        127
               2    0.69314    113
               3    1.09861    135
               4    1.38629    132
               5    1.60943    113


                RESPONSE PROFILES

                Response  BID
                ----------------
                    1      NO
                    2      YES


               RESPONSE FREQUENCIES

                    Response Number
               Sample       1        2
               -----------------------
                  1        90       37
                  2        86       27
                  3       116       19
                  4       123        9
                  5       107        6
```

APPENDIX Q. Logit Results for Recreational Access Hypothetical Bidding Question. (Cont'd)

```
                    RESPONSE PROBABILITIES

                        Response Number
                   Sample       1        2
                   ------------------------
                       1   0.70866  0.29134
                       2   0.76106  0.23894
                       3   0.85926  0.14074
                       4   0.93182  0.06818
                       5    0.9469   0.0531

                    MAXIMUM LIKELIHOOD ANALYSIS

                Sub        -2 Log      Convergence    Parameter Estimates
Iteration    Iteration   Likelihood     Criterion      1             2
--------------------------------------------------------------------------------------
    0           0        859.5025       1.0000        0             0
    1           0        522.57104      0.3920         -0.7594      -0.6377
    2           0        505.57449      0.0325         -0.7491      -1.0278
    3           0        504.97435      0.001187      -0.7331       -1.1299
    4           0        504.97302      2.6267E-6     -0.7323       -1.1350
    5           0        504.97302      1.479E-11      -0.7323      -1.1350


        MAXIMUM LIKELIHOOD ANALYSIS OF VARIANCE TABLE

        Source           DF   Chi-Square      Prob
        ----------------------------------------------------
        INTERCEPT        1       17.19   0.0000
        LNBID            1       35.15   0.0000

        LIKELIHOOD RATIO          3         5.14    0.1619


            ANALYSIS OF MAXIMUM LIKELIHOOD ESTIMATES

                                             Standard    Chi-
     Effect             Parameter  Estimate  Error       Square       Prob
     ----------------------------------------------------------------------------
     INTERCEPT                  1   -0.7323   0.1766     17.19        0.0000
     LNBID                      2   -1.1350   0.1914     35.15        0.0000
```

APPENDIX R. Review Comments of Jim Almond, Dr. Brian Sindelar, and John Hansen.

LEXINGTON
HOTEL SUITES & INNS

MEMORANDUM

TO: John Duffield

FROM: Jim Almond

RE: Final Report - Task 3

John, the report makes more sense to me than it did before. I still question the final level of the lease (i.e. $8.00) but now understand where it came from. I feel there are some factors that need to be considered that may have a bearing but overall the process makes sense.

The use of the private lease average payment to predict the state lease is good. State lands are random through out the state for the most part, so quality is not a factor as in Federal land holdings. This random location does have a bearing however, as inholdings the ranch does not actually have a choice whether to lease or not and therefore is locked in to whatever the price of the lease is.

Additional control by the landlord (state) also tend to cause more risk for that lease, for in the case of drought, total utilization may not be possible yet there is no reduction or refund of lease payment. This tends to reduce the value of the lease.

The survey considered only lease rates from 1991 or 1992. These rates were artificially high due to drought. (Explains some of the differences in Areas 20,30, and 90 compared to Area 50.) This tends to skew the sample at this time.

The data on page 23, Table 4-13 should be rechecked. An acre lease rate of $74.00 is out of line and needs to be analyzed as to its affect on the sample.

John, some "housekeeping" chores in the report:

1) the second paragraph on page 3 needs to be rewritten to say that 40% of the production is attributed to the land or 20 pounds. That 30% was considered to be the landlords share or 30% of 20 pounds equals 6 pounds. That 6 pounds times the price (of beef) equals the AUM fee.

2) The predicted values of BLM, Forest Service and BIA leases should be excluded from Table 4-23 on page 32 as information needed to totally analyze these has not been considered! i.e. land quality, location, etc. also some erroneous information may be included. That analysis was not part of our job and it's inappropriate in this report.

John, my phone in Phoenix is 602-279-9811. Please call if I can be of further help.

Jim A.

RANGEHANDS

238 Dry Creek Road
Belgrade, MT 59714
(406) 388-4625 or
(406) 587-3862

BRIAN SINDELAR, Ph.D
JOHN HANSEN, MS

01/25/93

John W. Duffield
Bioeconomics, Inc.
3699 Larch Camp Rd.
Missoula, MT 59803

Dear John:

This note is to advise you that I have reviewed the latest draft of the grazing lease survey report and to present the few areas of concern I have that have not been addressed. I think that the report and its content is very good and demonstrates a commitment to quality on your part. The only topics unaddressed which I believe should be covered, are as follows:

1. The drought conditions that have prevailed in large portions of the state may have influenced private lease prices and caused them to be artificially high. This could account for the reports of $18 - $20/AUM, which would push the average lease price higher than would be the case under "average" growing or climatic conditions.

2. State lands have no provisions for "non-use" such as the Forest Service or BLM grazing leases and permits. This means a producer must pay for a State lease regardless of whether or not there is forage for his livestock. In drought prone areas it is possible for a producer to only be able to graze stock on a State lease two out of three years (or at very least at a stocking rate less than he is paying for), which would mean he in effect pays about $ 6.00 an AUM if the default rate is about $ 4.00.

With the exception of the above points I think the report does an excellent job of addressing a difficult issue. If you have any questions feel free to call.

Sincerely,

John J. Hansen

FAX

Rangehands, Inc.
23833 Dry Creek Rd.
Belgrade, MT 59714

TO: Dr. John Duffield
Bioeconomics, Inc.
Missoula MT 59601

January 23, 1993

I have reviewed the Final Report of the Economic Analysis of Values of Surface Uses of State Lands. Congratulations on an excellent job of reporting, discussing, and summarizing your findings. I found the data and conclusions compelling. The five legs of the table you built were all of similar length. The hedonic model was predicting values pretty much in line with the other four analyses. This suggests good reliability and raised my comfort level.

My only suggestions:

Add a concluding statement to the summary that states something to the effect: "As a result of an intensive (and extensive) survey of Montana ranchers concerning grazing lease rates, and four additional methods of analysis, we conclude that current State lease rates for grazing are much lower than current fair market value." i.e. I would like to see a closing statement for the report that reflects the purpose and finding of the study. The present ending topic seems distractive, by introducing a new and previously un-discussed element.

Page 31 - last sentence. You could clarify the sentence by indicating that state leases are underpriced, based on market value PREDICTED BY THE HEDONIC MODEL. This sentence presently states AS FACT that leases are underpriced by exactly $3.42/AUM.

Otherwise, I found no faults (check 1st sentence on page 33..."colloborating model"?).

Thanks for the opportunity to review, and again, good work.

Brian Sindelar

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